RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

Vol. 55 SEPTEMBER, 1950 No. 3

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RADIOLOGY

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Vol. 55 SEPTEMBER 1950 No. 3

Roentgen Findings in Tumors of the Skull[1]

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Philadelphia, Penna.

Conventional roentgen examination makes possible a diagnosis of many cranial and intracranial tumors. Some tumors produce changes that are characteristic but in many the findings are sufficient only to indicate the presence of the growth. The roentgen findings of a number of benign and malignant tumors of the skull are considered in this paper. Displacement of physiologic calcification, due to brain tumors and other space-occupying diseases, has been considered in another publication (7).

Cysts of the skull are usually post-traumatic and arise in the diploe or beneath the pericranium. Tangential views reveal either expansion of both tables with widening of the diploe, or, more often, a smooth elevation of the outer table and a sharply defined sclerotic cyst margin.

Osteomas occur more frequently than other benign tumors. Their commonest site is the fronto-ethmoid region, but they arise also in the outer table and uncommonly in the inner table of the cranium (Fig. 1). Hyperostosis of the inner table is a bony overgrowth but not a true tumor. It usually is confined to the inner table of the frontal bone, but occasionally is more extensive.

Osteochondroma is a very rare primary tumor arising from the cartilaginous elements in the base of the skull, usually in the middle fossa. It is slow-growing, and produces symptoms by displacement and pressure erosion. In Cushing's large series of intracranial tumors there were only 3 osteochondromas (1).

Fig. 1. Osteoma of the fronto-ethmoid region.

Epidermoids or cholesteatomas are benign congenital tumors that occur in both the skull and brain, due to an embryonal growth disturbance. In the skull, the tu-

[1] From the Departments of Radiology, Temple University and Germantown Hospitals, Philadelphia, Pa. Presented at the Thirty-fifth Annual meeting of the Radiological Society of North America, Cleveland, Ohio, Dec. 4–9, 1949.

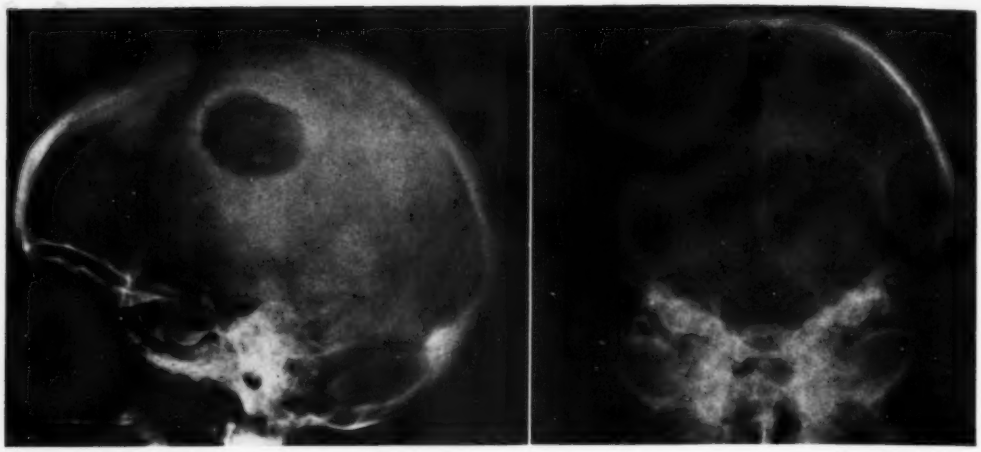

Fig. 2. Cholesteatoma or epidermoid of the parietal region. Uniform rarefaction of the diploe and sharp margination are characteristic findings.

mor arises in the diploe and expands either or both tables to produce a sharply marginated area of rarefaction, either circular or oval in shape. The common cranial manifestation presents a characteristic roentgen appearance (Fig. 2).

Cholesteatoma of the middle ear is not a neoplasm but the result of an ingrowth of the epithelium of the external auditory canal through a perforation of the drum into the tympanic cavity. It is nearly always a complication of chronic otitis media and mastoiditis and is manifest as a sharply marginated area of rarefaction in the tympanic cavity and mastoid antrum.

Dermoids arise in the brain and may extend to the scalp through a smooth mid-line defect in the cranium, often near the foramen magnum. Gross reported an intracerebral dermoid revealed by preliminary roentgenograms as a sharply marginated zone of radiolucency (4). Occasionally enough calcium is present in a dermoid to indicate its site. These tumors are of less common occurrence in the brain than epidermoids.

An oval radiolucent shadow in the region of the corpus callosum is most likely on the basis of a lipoma of the brain. Calcification in the periphery of the tumor makes identification and localization easy. The only other lesion to be considered in the absence of traumatic pneumocephalus is a dermoid. Since only one radiolucent dermoid has been reported (4), this tumor is unlikely to be the cause of a mid-line intracranial zone of radiolucency.

Hemangioma of the cranial bones is uncommon, yet the tumor occurs more frequently in only one other area of the skeleton, the spine. Two forms occur in the cranium, the more common honeycomb type with sharply defined borders, and the diffuse variety, characterized by greatly enlarged vascular channels. The diffuse variety often involves the vessels of the scalp, dura, and brain, besides those in the cranial bones. It is impossible to make a diagnosis of hemangioma on the roentgen evidence of enlarged vascular channels in the cranial bones, because normally there is considerable variation in the size and number of vessels. The diagnosis is based on a correlation of the evidence obtained clinically and by ordinary and contrast roentgen studies of the skull and brain, including angiography.

The honeycomb type of hemangioma presents a rather characteristic roentgen appearance, consisting of a sharply defined oval or round area of radiolucency with radial striations extending to, but not through, the outer table. The tumor starts in the diploe and expands both

tables. In appearance it differs from an invading hyperostotic meningioma because the margins of the latter tumor are ill-defined, and its spicules extend through the outer table.

Giant-cell tumors and fibromas occur rarely in the skull, and when present involve the maxillae and mandible more frequently than other areas. An ill-defined area of rarefaction in the diploe is infrequently a cranial manifestation of parathyroidism, but when this finding is present in a patient suspected of a parathyroid disorder, a skeletal study is necessary to detect other evidences of the disease.

Although meningiomas arise in the meningeal coverings of the brain, they frequently produce changes in the cranium detectable by a study of preliminary skull roentgenograms. The principal changes in the bone adjacent to the tumor are either hyperostosis or focal erosion or a combination of the two; occasionally the tumor contains enough calcium for visualization (Fig. 3). Common sites are the vault and base. In the series reported by Cushing and Eisenhardt, 131 of 295 intracranial meningiomas originated in the vault and 110 in the base (2). Nearly half of the tumors of the vault were in the parasagittal region, and 53 of 110 basal tumors involved the sphenoidal ridge. In the series of 41 sphenoidal ridge meningiomas reported by Pendergrass, Hope, and Perryman, positive roentgen findings were obtained in 35 cases, or 85.4 per cent (6).

Hyperostosis of the base of the anterior fossa with extension to the anterior clinoid is a not uncommon expression of a meningioma. An unusual site of a meningioma is demonstrated in Figure 4B, which shows extensive bony overgrowth of the petrous pyramid and mastoid process. Seven years earlier, the patient was advised to have surgery after roentgen studies revealed similar but less pronounced changes (Fig. 4A).

An important group of tumors that affect the cranium arise in the floor of the middle fossa and produce erosion of the base. An infrequently found primary tumor in this region is a chordoma. It arises from remnants of the notochord in the base of the skull and upper cervical spine and produces extensive destruction of the floor of the middle fossa, including the hypophyseal area. Basal and lateral views usually reveal the inferior margin of the tumor in the nasopharynx.

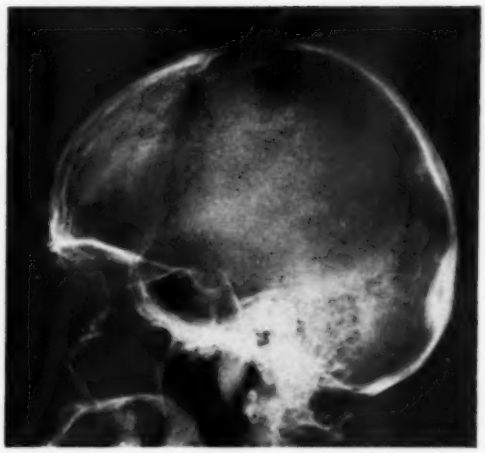

Fig. 3. Meningioma causing erosion of both tables of the skull. Calcification is demonstrated in the tumor (arrow).

Primary tumors of the blood vessels in the base of the skull and of the mucous membrane of the epipharynx and sphenoid sinuses cause bone destruction by pressure and direct invasion. Often these tumors occupy enough space in the epipharynx for roentgen demonstration. Biopsy of a mucous membrane tumor in this region usually reveals a carcinoma, or less likely lymphoepithelioma.

It is impossible in a paper of this type to consider fully the many tumors that expand and erode the sella turcica. The most common cause of sellar erosion is an adenoma of the pituitary. In Cushing's series, 18 per cent of brain tumors were pituitary adenomas (1). When the tumor expands the sella, it characteristically depresses its floor and sometimes breaks through into the sphenoid sinus. The dorsum is usually so thin that it presents a shell-like configuration in contrast to erosion of the top of the dorsum from pressure

Fig. 4. Meningioma producing extensive hyperostosis and deformity of petrous pyramid and mastoid process. Note marked increase in bony overgrowth in seven-year interval between examinations A and B.

by either an extrasellar tumor or hydrocephalus of the third ventricle.

Another tumor that arises in this region is the craniopharyngioma or Rathke pouch tumor. Flocculent calcification in the brain immediately above an expanded sella is strong presumptive evidence of this diagnosis. Other tumors found in the hypophyseal stalk region are meningioma, adamantinoma, carcinoma, and teratoma, but they are rare and, except for the meningioma, present little or no evidence of their existence in conventional roentgen studies.

Significant changes in the petrous portion of the temporal bones are demonstrable by roentgen examination in at least 60 per cent of patients with acoustic tumors (5). Erosion of the petrous ridge and apex and expansion of the internal auditory canal and porus acusticus internus occur, depending on the size and site of the tumor. Detection of these changes is not always easy, and evaluation of petrous findings is difficult, due to the prevalence of normal variations in the size and shape of the apex, ridge and canal. Therefore, a close correlation of the clinical and roentgen observations is necessary. Secondary changes in the sella, consisting of atrophy of the dorsum sellae and enlargement of the fossa, indicate a block of the ventricular system with resultant hydrocephalus of the third ventricle.

Primary osteogenic sarcoma and fibrosarcoma are rare. Osteogenic sarcoma complicating Paget's disease is reported, but its incidence is extremely low. Fibrosarcoma arises in the periosteum and dura and involves the tables secondarily.

Hodgkin's disease and lymphosarcoma cause osteolytic lesions in the cranium. The skeleton is involved in 12 to 15 per cent of patients with Hodgkin's disease and in 7 to 10 per cent of those with lymphosarcoma. The pelvis, spine, and ribs are more frequent sites than the skull. Since

the lesions are usually multiple and not characteristic, a diagnosis is dependent on the clinical findings and a positive biopsy of an accessible lymph node. Chloroma is a very rare malignant tumor affecting primarily either the lymphatic system or the bone marrow (3). The skull, sternum, vertebrae, and ribs are involved more frequently than other parts of the skeleton. Distinctive lesions are first seen in the diploe and present an appearance similar to that produced by a myeloma.

The skull is characteristically involved by numerous osteolytic lesions of various size in multiple myeloma. The similarity of the defects and the presence of multiple rarefactions in the ribs, spine, pelvis, and long bones, especially the femora, strongly suggest the diagnosis. Sternal marrow puncture often yields sufficient evidence for the diagnosis, but if several punctures are negative, bone biopsy may be necessary. Solitary myeloma of the skull is rare, but occurs in two forms—the trabeculated and rarefied types. The appearance of multiple lesions months after the detection of a solitary lesion indicates the latter as an initial manifestation of multiple myeloma.

Ewing's tumor occurs in the cranium as both a primary and metastatic lesion. Its manifestations in the cranium usually represent a metastatic form, with the primary lesion in one of the long bones. As a primary tumor, its incidence is higher in the long bones, pelvis, ribs, mandible, and scapulae than in the cranial vault. In the cranium the disease is usually osteolytic and not characteristic.

Neuroblastoma frequently metastasizes to the cranium and produces both osteolytic and osteoblastic changes. The tumor spreads to all parts of the skeleton and brain. It must always be considered in the differential diagnosis when osseous metastatic tumor is demonstrated in a young child, especially one under four years of age.

The skull is frequently involved by tumors that metastasize to the skeleton. Many tumors, including those originating in the breast, lung, and thyroid, produce lytic lesions of varying size in the cranium. The disease is blood-borne and, therefore, the diploe is usually the primary site. Metastatic disease from a primary carcinoma of the prostate is usually osteoblastic in character. Less frequently, breast carcinoma, Ewing's tumor, neuroblastoma, and Hodgkin's disease cause osteoblastic changes in the skull.

SUMMARY

Conventional roentgen examination is an invaluable procedure in the diagnosis of tumors of the skull. Many tumors produce changes that are sufficiently characteristic to identify their type. Others cause manifestations that indicate the existence of a neoplasm and the necessity of further study to clarify the nature of the disease.

The manifestations of a number of tumors of the cranium are discussed and illustrated.

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(*Para el sumario en español, veáse la página siguiente.*)

SUMARIO

Hallazgos Roentgenológicos en los Tumores del Cráneo

El examen roentgenológico convencional constituye un procedimiento inestimable para el diagnóstico de los tumores craneales. Muchas neoplasias provocan alteraciones suficientemente características para identificar el tipo de las mismas. Otras ocasionan manifestaciones que indican la existencia de una neoplasia y la necesidad de mayor estudio para esclarecer la naturaleza de la dolencia. Las manifestaciones de varios tumores craneales aparecen descritas e ilustradas.

Cerebral Angiography[1]

CARL F. LIST, M.D.

Grand Rapids, Mich.

INTRACRANIAL angiography demonstrates the cerebral blood vessels by injection of radiopaque material into the circulation of the carotid and vertebral arteries. When the roentgenographic exposure is made during or immediately after the injection of contrast medium, an arteriogram is obtained. A venogram is obtained when the roentgen film is exposed three or four seconds later. Under normal conditions, only blood vessels of the injected side are shown. Angiography of the carotid artery is easily performed and of great practical importance. Vertebral angiography is technically more difficult and not often indicated.

TECHNIC

For carotid angiography two methods are in use: the open or surgical and the closed or percutaneous method. The open method accomplishes surgical exposure of the carotid artery at the neck under local anesthesia. It has the advantage of greater accuracy and less chance of injury to neighboring structures or accidental paravascular injection. It permits separate injection of the external and internal arteries and requires only a small amount of contrast material. On the other hand, it is a time-consuming operation requiring a complete surgical set-up and several days hospitalization. The advantages of the closed method are its simplicity and speed. There is no need for hospitalization longer than a day. Percutaneous puncture of the carotid is, however, occasionally unsuccessful and sometimes fails to yield as excellent angiograms as those produced by the open method.

Vertebral angiograms can be obtained by surgical exposure and direct injection of the vertebral artery, by indirect retrograde injection of this vessel *via* the subclavian or, finally, by percutaneous injection of the vertebral artery.

It is always desirable to obtain angiograms in lateral and anteroposterior projections; for many purposes a stereoscopic pair of lateral films is valuable. With special mechanical equipment, multiple phase exposures can be made, recording the gradual progress of the contrast medium through the cerebral circulation.

Persons frequently performing angiography should be protected from x-rays by lead screening.

CONTRAST MEDIA

Two contrast media are available for angiography, but neither of them meets ideal specifications. The first, thorotrast, a 25 per cent colloidal suspension of thorium dioxide, produces excellent roentgenographic contrast and has no immediate ill effects, but it is radioactive and is permanently retained in the reticulo-endothelial system. Because of these undesirable properties, the total amount used should not exceed 35 c.c.

The second medium is diodrast, a concentrated (35 per cent) solution of an organic iodine compound. It affords satisfactory x-ray contrast and is totally excreted. Since its injection is painful and may cause convulsions, general anesthesia or preliminary anticonvulsive medication is necessary; moreover, the patient must always be tested for sensitivity to this drug.

INDICATIONS AND CONTRAINDICATIONS FOR ANGIOGRAPHY

Angiography is specifically indicated in patients with vascular intracranial lesions, as arterial occlusion, aneurysm, arteriovenous fistula, and arteriovenous malformation. The method has also great though

[1] Presented at the Thirty-fifth Annual Meeting of the Radiological Society of North America, Cleveland, Ohio, Dec. 4–9, 1949.

not exclusive value for the localization and pathologic anatomic diagnosis of expanding intracranial lesions, particularly those of the cerebral hemispheres and base.

Angiography is contraindicated in very old persons and those with recent thrombotic or embolic episodes, advanced hypertension and arteriosclerosis, and in blood dyscrasias. It may be used with caution in selected cases of intracerebral or subarachnoid hemorrhage. In non-localized neoplasms and those of the ventricular system, brain stem and posterior fossa, angiography is, as a rule, inferior to ventriculography.

DANGERS

Properly executed, angiography carries practically no risk, but faulty technic may cause air embolism or intravascular clotting with resulting hemiparesis. In cases of recent subarachnoid or intracerebral hemorrhage, one knowingly accepts a calculated risk, assuming that the information to be gained by angiography will outweigh the danger. In tumors of the cerebral hemispheres with high intracranial pressure, angiography is much safer than ventriculography because it does not change cerebrospinal hydrodynamics.

Since angiography usually is indicated in patients presenting potentially neurosurgical problems, it should be performed only where and when neurosurgical facilities are immediately available, and not be entrusted to the average neurologist or roentgenologist.

NORMAL ANGIOGRAM

Before attempting to evaluate pathologic cases, one must be fully familiar with the normal angiogram and its variations. Presence or absence of filling of the posterior cerebral artery and of one or both anterior cerebral arteries depends on anatomic conditions, such as the width of the communicant arteries, and on technical factors, such as the injection pressure. The intracranial venous system comprises the variable cortical veins, the deep cerebral veins, and the venous sinuses.

ANGIOGRAPHY IN VASCULAR INTRACRANIAL LESIONS

(1) Arterial occlusions are characterized by complete absence or marked coarctation of a major cerebral artery. Artifacts due to technical factors must, however, be ruled out.

(2) Extradural and intradural aneurysms are well shown by angiography, but the lesions as roentgenographically demonstrated may not correspond to the true size of the aneurysm and, in rare instances, there may be no contrast filling at all of a thrombosed aneurysm. Angiography is indispensable for the rational surgical treatment of intracranial aneurysm, since only by this method can the site of the lesion and the presence of an associated intracerebral clot be accurately determined.

(3) Arteriovenous fistula, usually of the carotid artery with the cavernous sinus, shows the arteriovenous shunt with absence or reduction of filling of the cerebral vascular tree and tremendous dilatation of the efferent veins.

(4) Arteriovenous vascular malformations exhibit greatly enlarged and tortuous cerebral arteries and veins, with or without interposed racemose capillary angioma. Arteries and veins are simultaneously filled in the arterial phase.

ANGIOGRAPHY IN EXPANDING INTRACRANIAL LESIONS

In expanding intracranial lesions angiography achieves two purposes. First it determines the location of the lesion by deformation and displacement of intracranial blood vessels; second, it may permit a pathologic anatomic diagnosis by revealing a specific vascular pattern. The enlargement of the cerebral hemisphere by a space-consuming lesion may be recognized by mid-line shift of the anterior cerebral artery to the opposite side (anteroposterior projection).

(1) Extracerebral expanding processes, such as an epidural or subdural hematoma, displace the cortical blood vessels from the

inner contour of the skull, leaving an avascular space.

Tumors of various lobes show localized vascular displacement. For example, temporal lobe tumors cause elevation of the sylvian vessels; frontal lobe tumors show an increased distance between the middle cerebral and anterior cerebral arteries and gross displacement of the latter; parietal tumors cause depression and separation of the sylvian vessels, etc.

(2) Careful study of the vascular pattern both on arteriograms and phlebograms permits the following diagnostic conclusions:

An area of complete lack of vascularity may indicate a cyst, abscess, hematoma, or epidermoid. Certain astrocytomas exhibit diffuse stretching and separation of arteries, with loss of finer arborizations.

On the other hand, a rich special blood supply can be angiographically demonstrated in about 40 per cent of the glioblastomas. An irregular vascular pattern of enlarged capillaries with "microaneurysms" and sinusoids is almost pathognomonic for this type of neoplasm. The presence of arteriovenous shunts may resemble those of vascular malformations.

Meningiomas frequently produce characteristic angiograms. They may have a double arterial supply which can be demonstrated by separate injection of the external and internal carotid arteries. Globular meningiomas may be outlined by circumscribed deformation of cortical vessels. Fine, brush-like newly formed arteries are commonly seen. Diffuse capillary opacification of the entire tumor (either in the late arterial or early venous phase) is typical. It indicates that the circulation in the rich capillary network of the neoplasm is slower than in the surrounding brain and thus retains temporarily the contrast medium.

Metastatic carcinomas and hypernephromas also may be demonstrated by their vascular pattern or capillary shadow.

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SUMARIO

Angiografía Cerebral

La angiografía intracraneal pone de manifiesto los vasos sanguíneos del cerebro con la inyección de una sustancia radioopaca en la circulación de las arterias carótida y vertebral. En la carótida la inyección puede hacerse por la técnica abierta o quirúrgica o por la cerrada o percutánea. La primera posee la ventaja de ser más exacta, la segunda, la de la sencillez y velocidad. Los medios usados son el torotrasto y el diodrasto. La angiografía vertebral no está indicada a menudo.

La angiografía está específicamente requerida en los enfermos con lesiones de los vasos intracraneales. También resulta útil para la localización y el diagnóstico de las lesiones intracraneales en vías de expansión, sobre todo de los hemisferios y la base. Está contraindicada en los enfermos muy ancianos y en los que han tenido recientes episodios trombóticos o embólicos, hipertensión y arterioesclerosis avanzadas, y en las hemodiscrasias. No debe ejecutarse más que cuando hay a mano medios neuroquirúrgicos.

Descríbense el angiograma normal y los obtenidos en las lesiones intracraneales vasculares y en vías de expansión.

Cerebral Aerography[1]

FRED JENNER HODGES, M.D.

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THROUGHOUT THE present decade and the one immediately preceding it, cerebral aerography has been used extensively in centers where neurosurgery is well established. The creation of unnatural density differences within the cranial vault, produced by the removal of cerebrospinal fluid and the introduction of air or some other gas, has proved itself to be an uncommonly effective means of providing detailed information concerning intracranial lesions prior to surgical attack.

Either of two means of replacing fluid with air can be used to advantage in the study of intracranial situations. The two procedures, air encephalography and ventriculography, have individual spheres of utility and are not to be considered as competing technics.

Air encephalography, accomplished by puncture of the cisterna magna through the foramen magnum or by lumbar puncture, allows for the indiscriminate removal of fluid from the subarachnoid spaces and the ventricular system alike providing that the normally communicating formina are not obstructed. As the result, when the withdrawn fluid is replaced with gas, the greatly increased transparency of the normally fluid-filled spaces provides an opportunity to observe the inner as well as the outer surfaces of the brain. Actually air encephalography finds its greatest use when surface lesions are anticipated. Brain atrophy can be identified by the appearance of greatly deepened cortical sulci and correspondingly widened subarachnoid spaces (Fig. 1), and adhesive arachnoiditis results in the complete obliteration of subarachnoid spaces over the surface of the brain in the area involved.

Meticulous technic in the matter of fluid withdrawal and the delivery of gas into the subarachnoid space, as well as in the preparation of roentgenograms of high quality, is essential if pneumoencephalography is to yield its best results.

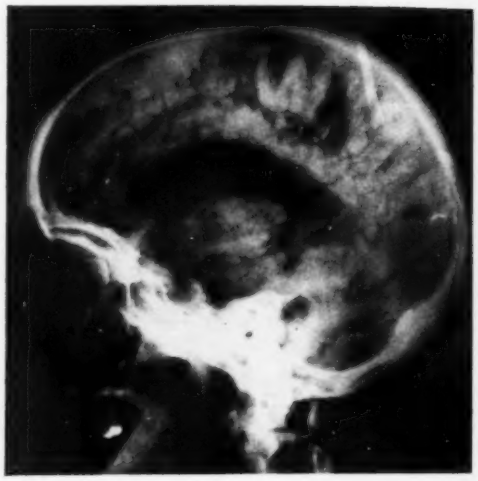

Fig. 1. Pneumoencephalogram showing definite evidence of cortical atrophy in the parietal lobe.

Ventriculography calls for direct ventricular tap through a surgical opening in the skull, drainage of cerebrospinal fluid from the ventricular system, replacement of fluid with gas, and the preparation of many accurately executed stereoscopic pairs of roentgenograms. This procedure is not one which is to be undertaken lightly. As its descriptive name implies, it provides, when successfully carried out, an opportunity to examine all or a part of the ventricular system of the brain in its true relationship to recognizable bony landmarks. Alterations from the expected size, shape, and position of the various cavities within the brain can often be translated into terms which describe the location, the extent, and sometimes the character of the lesion under consideration.

[1] From the Department of Roentgenology, University of Michigan. Presented at the Thirty-fifth Annual Meeting of the Radiological Society of North America, Cleveland, Ohio, Dec. 4–9, 1949.

Fig. 2. Routine ventriculographic examination.

It is axiomatic that ventriculography is reserved for use in situations where symptoms and signs indicate beyond reasonable doubt that some serious intracranial abnormality exists. When clinical signs of increased intracranial pressure are encountered, ventriculography is the only aerographic technic which is permissible. Removal of fluid by way of the spinal canal under such circumstances is to invite fatal herniation through the foramen magnum. Ventriculography is indicated when convincing evidence is lacking regarding the exact location, the relative size, and the probable character of a lesion within the cranial vault, for the treatment of which surgical methods are being contemplated. In actual practice, when used on this basis, ventriculographic examination often leads the examiners into desperate situations which offer only the most forlorn hope of successful surgical removal of the offending lesion. Since ventriculography is never to be used knowingly in the absence of serious intracranial disease, and since it is very commonly followed by extensive intracranial surgery, it seems unlikely that valid mortality figures for the procedure itself can ever be determined. It is difficult, if not impossible, to gauge to what extent ventricular tapping and subsequent inflation may be directly responsible for death.

To produce a satisfactory ventriculographic survey of a patient, the closest possible teamwork is required between neurosurgeon and radiologist. Both must be experienced and capable. The radiologist must have at his disposal dependable apparatus ready for immediate use as soon as the surgeon has removed as much ventricular fluid as possible and replaced it with gas. It is good practice to expose one pilot film from occiput to forehead, with the occiput dependent, in order to determine whether drainage has been sufficiently extensive to allow adequate inflation of the ventricular system. Once it has been established that sufficient gas has been introduced to outline the ventricles effectively, stereoscopic pairs of films made with the skull in six different

Fig. 3. Displacement of lateral ventricles produced by a large tumor of the left temporal lobe.

positions must be prepared if information regarding all parts of the ventricular system is to be forthcoming (Fig. 2). Because a variable amount of residual cerebrospinal fluid which cannot be drained from the ventricles will always gravitate to the dependent portions of the hollow spaces, it is necessary to utilize many skull positions to accomplish in piecemeal fashion optimum inflation of all parts of the system. Direct, true lateral projections, first with one and then the other side of the head dependent, are necessary to compare the configuration, size, and position of the right and left lateral ventricles. Important information regarding the status of the third ventricle is often obtained from such films.

Additional lateral projections, one with the brow down, one with the occiput down, serve to show respectively the posterior and anterior horns to best advantage. These views are helpful also in studying the third ventricle.

Postero-anterior projections with the occiput dependent (the position used for the pilot view) are needed to determine accurately the position of the frontal and temporal horns with respect to the mid-line of the cranium.

A final pair of stereoscopic mates prepared in anteroposterior projection, with brow down and head sharply flexed to permit gas to gravitate upward into the posterior horns and more particularly the aqueduct and fourth ventricle, are essential if the true status of posterior fossa structures is to be determined.

Whenever one attempts to shorten the procedure it is at the risk of omitting a projection which might have been most helpful. In the current illustration the first five pairs of stereo films serve only to show bilaterally symmetrical internal hydrocephalus. The sixth pair of films prepared, when residual fluid has been drained into the forward reaches of the ventricular system, shows the greatly inflated fourth ventricle sharply displaced to the left, proving that the lesion responsible for high-grade obstruction of the ventricular system lies deep in the posterior fossa to the right of the mid-line. In this case the offending lesion was proved to be a cerebellar astrocytoma.

Because roentgenograms of the sort we have been discussing must be examined in the greatest detail, and because density differences of rather slight degree must be apprehended deep within the cranial vault, it is imperative that exposures be made with the use of a Potter-Bucky diaphragm. Relatively heavy exposures are best suited to this type of examination. The skull-filming table developed at the University of Chicago is ideally suited to this sort of work. It permits the grid surface to be brought into proper relation with the skull, once injected gas has been manipulated into the desired portion of the ventricular system. With such apparatus it is possible also to control the angle at which the central x-ray beam enters and leaves the skull and impinges upon the film.

It is routine procedure at the University Hospital, University of Michigan, for the neurosurgeon to enter the skull at a point

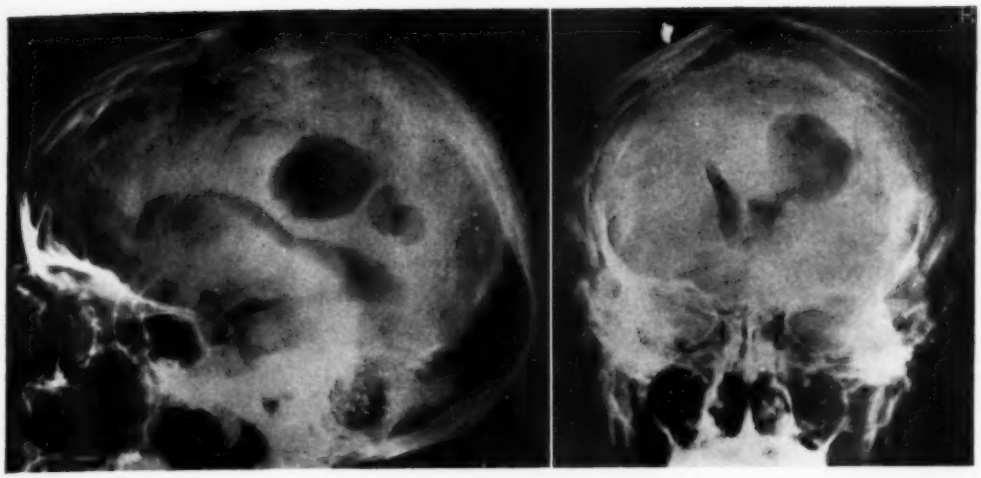

Fig. 4. A cystic ependymoma situated in the right cerebral hemisphere above the lateral ventricle.

4 cm. above and 4 cm. posterior to the tip of the right ear when preparing to carry out ventricular puncture. If successful drainage cannot be accomplished from this side, a second opening is made in the corresponding position on the left, and sometimes both approaches are used. This approach involves a relatively silent cortical area at the closest possible point to the underlying lateral ventricle. The necessary surgical procedure is carried out under local anesthesia. The large majority of intracranial lesions for which ventriculography is employed are associated with abnormally high intracranial pressure. The hazard of herniation of the brain through the foramen magnum, very real when cerebrospinal fluid is withdrawn from the spinal canal, does not apply to direct ventricular puncture.

Cursory examination of the films serves to determine the presence or the absence of generalized ventricular dilatation and major degrees of displacement to right or left of the mid-line. In Figure 3 mid-line structures are seen to be shifted sharply toward the right, reflecting the presence of a large left temporal tumor. Beyond this point more than ordinary diligence is required to piece together from six stereo pairs full information regarding the status of the ventricular system.

Sometimes in the process of inserting the needle into the lateral ventricle the lesion under consideration is encountered by the needle tip. If the lesion is cystic in type, it is possible for the surgeon to aspirate some of its contents and to replace the fluid with gas. A situation of this sort which yielded spectacular information regarding the tumor is shown in Figure 4. The cystic tumor was approached from the right side of the skull, while a second opening on the left was used to inflate the ventricular system. Displacement of mid-line structures to the left is of relatively slight degree because the tumor is high and centrally placed in the right hemisphere. Without the gas-outlined cavity to indicate total size, the magnitude of this lesion could not have been accurately appreciated from the status of the ventricles alone. The tumor was found to be a cystic ependymoma.

Internal hydrocephalus always bespeaks obstruction to the flow of cerebrospinal fluid from the lateral ventricles to the fourth ventricle and beyond. As an exception to this broad statement, it is to be remembered that enlargement of ventricles may reflect widespread brain atrophy compensated for by the accumulation of excessive amounts of fluid within the ventricular system. Figure 5A shows

Fig. 5. Internal hydrocephalus produced by third ventricular tumor. A. Frontal plane projection. B. Soft-tissue mass within the posterior portion of the third ventricle is best seen viewed from the side with the forehead down.

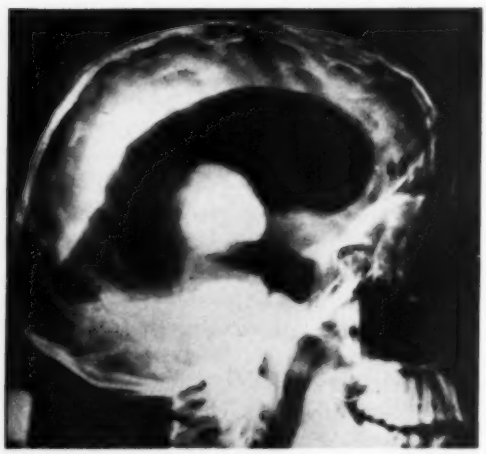

Fig. 6. Third ventricular astrocytoma completely surrounded by air within the lateral ventricles.

a profound degree of internal hydrocephalus without demonstrable shift in mid-line structures. The septum pellucidum dividing the anterior horns of the lateral ventricle is clearly defined and lies directly in the mid-line of the skull. Beneath these structures the greatly dilated third ventricle is to be seen obscured in its central portion by a soft tissue mass which must be lying within this cavity and which may well be responsible for obstruction of the aqueduct of Sylvius, which in turn has resulted in the dilatation of ventricular structures proximal to this point. The exposure reproduced in Figure 5B, one of a pair of lateral projections with the brow down, shows nicely how air has risen to fill the posterior portions of the lateral ventricles and that part of the third ventricle which is not occupied by the soft tissue mass. This mass actually is indenting the third ventricle from below and behind a point which is nicely shown by the displacement of the pineal calcification. At operation the tumor was removed from its bed in the posterior portion of the third ventricle and found to be a teratoma containing intestinal epithelium, skin and accessory structures, mesodermal tissue, glial tissue, fat, and blood vessels.

Sometimes tumors of the third ventricle stand out in roentgenograms as solid masses virtually surrounded by gas-filled ventric-

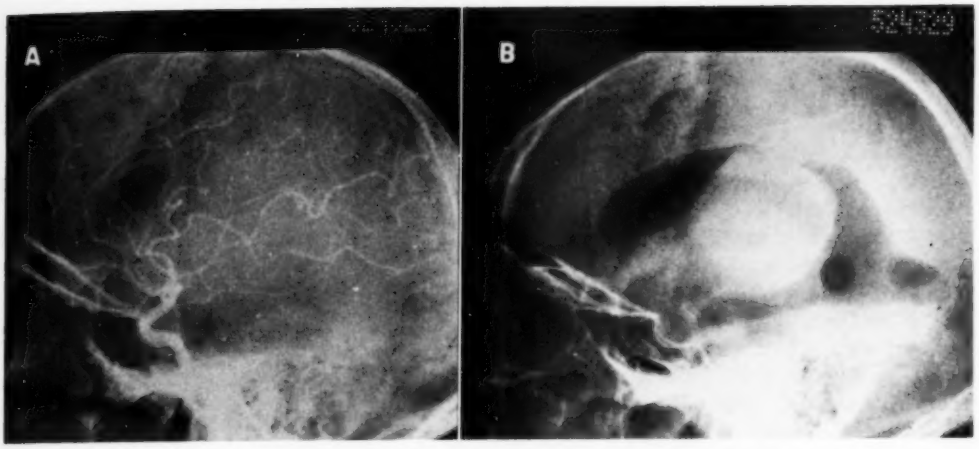

Fig. 7. A. Normal carotid angiogram. B. Ventriculogram of same patient, showing solid mass encroaching upon the lateral ventricle from the floor of the brain.

ular structures. Such an example is shown in Figure 6. A girl of fourteen presented signs of increased intracranial pressure associated with abnormal reflexes representing pyramidal tract abnormality. Here the rather profound degree of internal hydrocephalus provides a transparent background against which the sizable mass within the third ventricle stands out in bold relief. On operation this was found to be an astrocytoma arising from the septum pellucidum and the roof of the third ventricle. It had grown in size until it completely occluded the third ventricle, with resultant profound enlargement of both lateral ventricles.

While ventriculography can be most helpful in furnishing information about lesions within the cranium which may be difficult to appraise by other procedures, it certainly is not true that other methods of study may not be considerably more valuable, depending upon the location and the character of the lesion in question. Air encephalography has a field of utility quite apart from ventriculography. Cerebral angiography can divulge the presence of situations which neither of the aerographic methods at our disposal can equal. Electroencephalography is rapidly assuming a position of considerable importance, whether employed alone or in conjunction with roentgen examination. The selection of the particular type of examination to be used in any individual situation represents an important decision which must of necessity rest upon individual circumstances. In Figure 7 an interesting situation is shown in which cerebral angiography (A) fails to provide any striking indication of an intracranial lesion. On the right, a ventriculogram of the same patient (B) shows a very large abnormal mass arising from the floor of the brain and projecting extensively upward, almost bisecting the lateral ventricle. Large as this lesion was, its position within the brain was such that the major vessels normally seen following internal carotid injection were neither occluded nor grossly displaced. In the case of this thalamic tumor ventriculography proved itself to be a far better diagnostic procedure.

When wisely chosen and well performed pneumoencephalography and ventriculography are highly refined and accurate methods for the examination of intracranial structures. Viewed in proper perspective they represent two of a number of procedures which have come to be almost indispensable to the diagnosis and surgical treatment of intracranial lesions.

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SUMARIO

Aerografía Cerebral

Escogidas juiciosamente y bien ejecutadas, la neumoencefalografía y la ventriculografía constituyen métodos altamente delicados y exactos para el examen de los órganos intracraneales. El éxito de las mismas depende del empleo de una técnica meticulosa tanto en la introducción cuanto en la distribución del gas en la bóveda craneal y en la posición y exposición de las películas.

La neumoencefalografía encuentra su mayor utilidad cuando se esperan lesiones superficiales. La ventriculografía se reserva para las situaciones en las que los síntomas y signos indican más allá de toda duda razonable que existe alguna grave lesión intracraneal, pero en las que faltan datos convincentes con respecto a la localización exacta, tamaño relativo y probable naturaleza de la misma.

Después de la extracción, por el neurocirujano, del líquido ventricular y la sustitución de éste por gas, es buena práctica que el roentgenólogo exponga una película guía u orientadora, del occipucio a la frente, con el occipucio más bajo, para determinar si la canalización ha sido suficiente para permitir la adecuada insuflación del aparato ventricular. Luego se obtienen pares estereoscópicos con el cráneo en seis posiciones distintas: verdaderas directas posiciones laterales con un lado primero y luego el otro lado de la cabeza colgante; otras proyecciones laterales, una con la frente baja y otra con el occipucio bajo; una proyección posteroanterior con el occipucio bajo; vista anteroposterior con la frente baja y la cabeza en flexión aguda.

Se discuten e ilustran con grabados las aplicaciones de la aerografía cerebral, con referencia particular a las neoplasias.

Role of Radiatian Therapy in the Control of Malignant Neoplasms of the Brain and Brain Stem[1]

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MALIGNANT TUMOURS of the brain and brain stem compel an attitude of critical optimism on the part of the neurosurgeon and the radiation therapist in their approach to the problems both of the attack upon the individual tumour and the assessment of the results in the several types of neoplasm.

The constantly painstaking, sometimes bold, progress of neurosurgery over the last two decades is well known. The drama of surgery is enhanced, in this field, by the close proximity of vital structures, the often critical state of the patient, and the urgent need to avoid further damage to function.

The forte of radiation therapy is more humdrum, save possibly in the medulloblastomas, and not without some disappointment and headache. But if, ultimately, it is to be found valuable in the control of extension or recurrence of brain neoplasms (which the surgeon rarely can remove *in toto*), a consistent pattern or method of treatment must be used intelligently in a fairly large series of cases, and then critically surveyed. This may take some years, and optimism may encounter a few set-backs.

Because of the nature and location of these malignant tumours, the obscurity of symptoms and delayed clinical recognition, there will be a fairly high loss within relatively few months regardless of the means of treatment. This is further accentuated by the fact that about one-third of all these neoplasms are the most rapidly growing and malignant of the gliomas, the *glioblastoma multiforme*. A number of them arise in surgically inaccessible regions, so that even local decompression by aspiration of a portion of the tumour is dangerous to life. Some will endanger life by obstruction to the cerebrospinal fluid pathway, and may not be amenable to Torkildsen's ventriculo-subarachnoid cannulization nor the more recently suggested ventriculo-peritoneal intubation.

During the ten-year period from Jan. 1, 1939, to Dec. 31, 1948, 243 patients with malignant tumours of the brain and stem, 13 with meningeal fibroblastomas, and 32 with pituitary adenomas have been referred from the Neurosurgical Service of the Royal Victoria Hospital and Montreal Neurological Institute, and accepted for radiation therapy. The pattern of treatment, especially of the gliomas of the brain and stem, has been maintained consistently, and the analysis of the results will show some revision of our previous report (1944) upon the first five years of the period.

For 46 patients in the series, treated prior to January 1948, follow-up records are incomplete at this time (18.1 per cent). Thirty patients treated in 1948 are grouped with the incompletely followed inasmuch as their survival periods had not yet extended beyond the average post-operative survival observed by Penfield, Elvidge, and Cone (1935). Only brief comment will be made upon the *medulloblastomas* (32 cases), concerning which we have recently published a report.

For the purpose of this symposium the major points of interest are *glioblastoma multiforme*, *astrocytoma*, and the *malignant gliomas, unclassifiable further*. These comprise two-thirds of the malignant neoplasms of the brain and brain stem, glioblastoma multiforme and its possibly close associate, the relatively rare astroblastoma, being as frequent as the

[1] From the Department of Radiology, Royal Victoria Hospital, Montreal. Presented at the Thirty-fifth Annual Meeting of the Radiological Society of North America, Cleveland, Ohio, Dec. 4–9, 1949.

astrocytomas and the unclassifiable malignant gliomas together.

GENERAL PRINCIPLES OF TREATMENT

In the radiation therapy of malignant lesions of the brain, close co-operation between neurosurgeon and radiologist is imperative. The patient must be hospitalized for an appreciable portion of his course of treatment. Daily, often hourly, observation of his clinical status by trained personnel should be possible, and any emergent situation dealt with promptly and effectively. Full facilities for relief of excessive intracranial pressure must be at hand. Ventricular aspiration may be required. Torkildsen drainage may have to be established.

As accurate localization of the tumour area as possible, with estimate of its size, must be had in order that multiple ports may be used to permit proper distribution of the radiation throughout the neoplasm. The initial daily doses should be relatively small (100 r), given preferably through but one of the several (usually four) ports serially on succeeding days for the first week. If no untoward reaction ensues, the daily dose and number of ports may be gradually increased, so that by the tenth day it usually will be possible to administer 150 to 200 r through each of two ports per day, with radiation of a half-value layer of 2.0 mm. Cu.

Irradiation may be begun as soon as the scalp incision is firm, appreciable subcutaneous fluid or edema is reduced, and the intracranial pressure will permit. The scalp should not have any medication or shampoo throughout the course of radiation therapy, and preferably for six weeks after its conclusion. Then a bland soap solution with additional olive oil may be used, sparingly.

Hyperthermia is not uncommon, especially in the presence of tumours near the base of the brain. The professional staff must watch for any unusual increased degree of hyperthermia, headache, drowsiness, slowing of speech, or stupor, as indication of an unfavorable state.

As yet, our neurosurgical and neuropathologist colleagues have not observed, in the patients of this series, either clinically or cytologically, any evidence of permanent damage to normal brain tissue by irradiation.

CHARACTERISTICS OF THE SEVERAL TUMOUR TYPES

Generally, the relative sensitivity of nervous tissue to irradiation is of a low order. However, that of the malignant tissue is considerably higher. This is especially evident in medulloblastoma and neuroblastoma. Of late, the studies by Mr. Dott and Professor McWhirter on the effect of irradiation upon the meningeal fibroblastomas, previously considered resistant, suggest that our earlier concept of radiation resistance has not been accurate.

As we have already indicated, in some contrast to malignant disease in other organs or systems, a high rate of early casualty is to be expected. If irradiation can reduce this percentage somewhat, but especially if it will induce longevity beyond that to be anticipated without such treatment and not impair function further, the gain will have been worth the effort.

In view of the great difficulty of determining in these cases the probable time of inception of disease, or that of the earliest symptoms, the date of operation (biopsy, incomplete or supposedly complete removal of tumour) followed by irradiation is used to compute duration of life and survival rates.

Glioblastoma multiforme, comprising about a third of all the gliomas and half of the adult lesions, is a vascular, invasive, expansile, non-capsulated tumour which appears to arise from the relatively undifferentiated bipolar spongioblasts. Connective tissue is scanty, usually chiefly about the thin-walled blood vessels. Thrombosis is common, with hemorrhage, local softening, and cystic degeneration of the tumor. Growth is rapid, recurrence after operation to be expected. The average duration of life from onset of symptoms has been thought to be of the order of

twelve months. Penfield and associates found an average postoperative expectancy of eight and a half months.

At the time of our previous report, we were quite encouraged over the relative prolongation of life which apparently had been obtained with thorough irradiation of these tumours, attaining a maximum of forty-seven months in one of those then still alive, and of sixty-four months in one of those then dead; an average of twenty-five months in the living group of 5 and of 14.3 months in the 20 who had died.

The present longer view of that group, at the ten-year period, reveals an increase of the average survival period of the known dead to 15.6 months after operation and irradiation. The duration of life for the 7 patients remaining alive, of the 49 with glioblastoma multiforme on whom we have full data in the ten-year series, is twenty-three months. However, the 41 known to be dead, after complete treatment, had an average of but 13.3 months from diagnosis, operation, and irradiation to terminus.

More significant is the comparison of life expectancy, as shown by the percentage who survived for various periods in the three series reported by Elvidge, Penfield and Cone (after operation), Dyke (after operation and irradiation), and ourselves (after operation and irradiation).

Although we cannot be as optimistic as we were on the previous occasion, there is appreciable evidence that, in spite of the highly malignant character of this neoplasm, life, and in more than a few instances useful life, can be increased with proper irradiation of glioblastoma multiforme. A minimum tumour dose greater than 7,500 r will be required to obtain further improvement.

Astrocytoma is a considerably slower-growing malignant glioma, common in the cerebellum of children and in the frontal and temporal lobes of the adult. More highly differentiated elements of the same stem-cell series as the glioblastoma multiforme, spongioblastoma (polare), and astroblastoma form a tumour which commonly becomes cystic. In contrast to the degenerative, ragged cystic areas in glioblastoma, the astrocytoma is characterized by smooth-walled cysts about whose borders the tumour may appear as a meniscus. There is some doubt as to whether these are true degenerative cysts or are a peculiar function of the neoplasm. Mitoses are few. Hemorrhage is rare.

LIFE EXPECTANCY IN GLIOBLASTOMA MULTIFORME, BASED ON SURVIVALS IN THREE SERIES

Duration of Life	Elvidge, Penfield, and Cone (1935), Post-operative	Dyke (1944) After Operation and Irradiation	Present Series (1939–48) After Operation and Irradiation
12 months or more	31.8%	40.5%	47.9%
15 months or more	13.6%	23.9%	29.1%
20 months or more	9.1%	10%	22.9%
30 months or more			8.3%

In the child, astrocytoma may be dangerous to life because of its common location in the cerebellum. In the adult, a long evolution period may delay diagnosis.

Elvidge, Penfield and Cone noted an average postoperative survival period of 36.2 months, which but a third would attain. Dyke considered that if irradiation were added, 48.7 months might be anticipated in slightly less than a third of these patients. In our earlier report, we were not so impressed with our results, and, in view of the higher differentiation of this tumour, considered that appreciably higher dosage would be required if any advantage were to be gained. As of December 1948, 8 of the group reported in 1944 were still alive, fifty-eight to one hundred and twenty-five months after operation and roentgen therapy, with an average duration of 94.4 months. Twenty-three of the patients with astrocytoma in the entire ten-year series are alive more than a year after operation and full irradiation, with an average of 52.6 months survival. In comparison with our earlier report of seventeen months for the known dead, the average survival for all those with astrocytoma now known to be dead is 33.94 months.

Comparing the life expectancy in this group (as for glioblastoma multiforme, above), it would appear that irradiation has added significantly to the survival period, especially after the second year, almost 44 per cent having lived over thirty-six months, 34 per cent over four years, and 24 per cent longer than seventy-two months.

LIFE EXPECTANCY IN ASTROCYTOMA, BASED ON SURVIVALS IN THREE SERIES

Duration of Life	Elvidge, Penfield, and Cone (1935), Post-operative	Dyke (1944) After Operation and Irradiation	Present series (1939–48) After Operation and Irradiation
12 months or more	90.5%	81%	87.8%
24 months or more	66.6%	64.3%	56.1%
36 months or more	33.3%	38.1%	43.9%
48 months or more	14.6%	28.5%	34.0%
72 months or more			24.3%
96 months or more			9.7%

A minimum tumour dose in the region of 9,000 r is our present goal, in the hope that we may afford an increasing number of these patients an additional period of useful life.

The *unclassified malignant gliomas* are represented by a group of 29 patients whose tumours on further microscopic study are not sufficiently characteristic for the neuropathologists to agree upon or to favour predominantly further classification. Of these, 9 are known to be alive with an average survival of forty-three months, 9 dead with an average duration of life of 18.3 months after operation and irradiation. These tumours, therefore, appear to fall in between the two major types as to degree of malignancy and susceptibility to irradiation.

In general the plan of treatment closely followed that for glioblastoma multiforme.

Astroblastoma has been considered by some as closely allied to glioblastoma multiforme. We have treated only 3 of these tumours. One patient is still alive ninety-seven months after operation and irradiation; two are dead at eleven and sixty-eight months, respectively.

Spongioblastoma (*polare*), a rather indolent tumour, most commonly found along the brain stem, has been thought closely similar to astrocytoma in its reaction. Cranial nerves are commonly affected. Surgical removal is usually impracticable. We have treated 2 cases in the ten years. One patient is alive sixty months following operation and irradiation, and one is untraced after fourteen months.

Oligodendroglioma and *oligodendroblastoma* have been of similar minimal frequency, 3 of the former and 2 of the latter being included in this series. A firm tumour, somewhat resembling a medulloblastoma histologically, the oligodendroglioma usually presents in the cerebral hemispheres in adult life. Local degeneration with fatty deposit is followed by calcium deposition about the blood vessels, which show changes in their intima. This calcification may be discovered on routine skull roentgenograms. Although this is a relatively indolent tumour amenable to surgery, we consider irradiation advisable, additionally, because of the tendency to recurrence in the more malignant form. Two of the oligodendroglioma patients lived fifty-one and fifty-two months, respectively; one is untraced after incomplete treatment. One of the patients with oligodendroblastoma is alive at forty-six months; one died thirty-eight months after operation and irradiation.

The general pattern of radiation therapy should approach that for astrocytoma, for these tumours do not resemble medulloblastoma in radiation sensitivity.

Ependymoma and *ependymoblastoma* arise in the walls of the ventricular spaces, especially the lateral ventricle in children and the fourth ventricle. The tough, relatively avascular, slowly growing ependymoma is not especially malignant in itself; but, because of its location and the tendency to reimplantation of fragments farther along the cerebrospinal fluid pathway, it may cause dangerous obstruction. This is commonly encountered as one of the gliomas of the spinal cord. McWhirter considers *ependymoma* as relatively radia-

tion insensitive, *ependymoblastoma* as relatively sensitive.

The eight ependymomas and five ependymoblastomas in our series have occurred predominantly in adults and in the third and fourth ventricles. The follow-up information is incomplete at this writing. One patient with ependymoma is untraced, one is known to be alive at twenty-eight months, another at one hundred and four months. One with ependymoblastoma died fifty-eight months after operation and one is untraced. One ependymoma was incompletely treated, and 7 of the group are untraced after twelve, twenty-eight, thirty-six, and forty-two months for the ependymomas; twelve, eighteen, and thirty-three months in the case of the ependymoblastomas.

The group is too small and the data are too incomplete to warrant further comment, save that radiation therapy should be afforded these patients.

Two patients with *neuro-epithelioma* lived but nine and seventeen months. These primitive spongioblastic tumours are rare in the brain, more frequent in the spinal cord. One occurred in a child of eight, the other in a man of forty-one.

Haemangio-endothelioma (one case) and *haemangioblastoma* (2 cases) fortunately are rare also. These tumours arise in vascular anlage in the region of the posterior portion of the fourth ventricle, and display a tendency to development of a cystic area, requiring surgical removal of both tumour and cyst if at all possible. These neoplasms seem to be of hereditary character, commonly associated with cystic disease of the pancreas and kidney.

McWhirter considers them insensitive to radiation. One of our patients with haemangioblastoma is alive sixty-two months after operation and irradiation. The one with haemangio-endothelioma was known to be alive at seventy-nine months. Information is incomplete on this and the second haemangioblastoma.

The single case of *papillary adenocarcinoma of the choroid plexus* is untraced after twenty-two months. This is a rare, solid cauliflower-like lesion without cyst formation. Cushing and Davis found the majority of such tumours in the mid-line of the fourth ventricle or near and often mistaken for acoustic tumours, the latter possibly arising from the choroidal tuft at the foramen of Luschka.

The 6 cases classified as *perithelial sarcoma* are still under study. One patient is known to be alive at twenty-four months, one dead at twenty-one months. The role of radiation therapy is still to be determined in this tumour.

Pinealoma and *pinealoblastoma*, soft epithelioid tumours, induce a syndrome in which signs of endocrine disturbance, cranial nerve lesions, and abnormality of gait and posture appear in varying degree. In addition to the pressure effect of the tumour, it is prone to fragment, with reimplantation widely along the ventricular walls. The more differentiated pinealoma is considered insensitive to irradiation in about two-thirds of the cases; the less common pinealoblastoma is somewhat more sensitive. We have treated but one case in the past ten years, and its follow-up is incomplete.

Medulloblastoma, a moderately rapidly-growing tumour common in the cerebellum during childhood and dangerous to life, although almost the most radiosensitive of the intracranial tumours, shows an unusual "fertility" and ability to recover from radiation therapy and to disseminate throughout the entire cerebrospinal axis. The prognosis is poor. Experience in our institution and that of others strongly suggests that a minimum degree of traumatization with resultant opportunity for dissemination of tumour cells or fragments of tissue must govern the choice of treatment.

Unfortunately, a high proportion of these cases are not diagnosed in the earlier stages of tumour development, and upon admission the patients are in a very critical state. We recently have reported with Dr. W. V. Cone upon a group in which he has effectively used aspiration biopsy through a twist-drill hole. The results

so far demonstrate unquestioned earlier return to normal functional activity and suggest an improvement in duration of life.

Early radiation therapy plays a major part in the improvement of these patients. We regard them as "emergencies." The posterior fossa should be treated initially, followed by irradiation of the entire spinal axis.

Three patients treated by irradiation alone (after "twist-drill" biopsy) are alive, with an average duration of life of 34.3 months. One child, who has lived forty-seven months since the aspiration biopsy and irradiation, is not normal, but is in fair condition. Another is unusually well. For the 15 in the general series who have died, the majority having had varying degrees of radical surgical intervention, the average length of life was 16.6 months (minimum two months, maximum fifty-five).

Meningioma and *meningeal fibroblastoma* are under restudy at the present, in view of the observations of Professor McWhirter and Mr. Dott. So far our results with irradiation as an adjuvant to surgery are encouraging. Space does not permit any extended comment, nor is the situation entirely clear.

The Edinburgh group consider that some 78 per cent of these tumours are radiation-sensitive. These have a shorter symptom history (two years), a cerebral blood supply, and a tendency to induce more bone reaction than the insensitive group. The latter have a clinical history of some five and a half years and a dural blood supply; they are firmer, homogeneous tumours with a granular surface and evenly distributed vessels as seen at operation.

McWhirter's five-year survival rate is of the order of 60 per cent. A tumour dose of 5,000–6,000 r is required.

Some 32 patients with *adenomas of the pituitary* have been treated in our department over the past ten years. These tumours require a further rather extended consideration and will not be dealt with here.

CONCLUSIONS

In summary, radiation therapy has a major role to play in the control of malignant tumours of the brain and brain stem.

It is not a procedure to be entered upon lightly but requires complete and close co-operation between neurosurgeon and radiation therapist.

As with the neurosurgeon in his care of the patient, personal daily attention by the radiologist, with adjustment of the plan of treatment to the clinical status of the patient, is mandatory.

Radiation therapy in our institutions has increased the duration of life, and in not a few cases of useful life, as has been discussed in regard to the various tumour types.

Continued conservative optimism is still warranted, provided that the various considerations discussed are fully appreciated, and the optimum conditions fulfilled.

NOTE: The co-operation and assistance of Drs. Penfield, Cone, and Elvidge and their staff in the Department of Neurology and Neurosurgery, Royal Victoria Hospital, and in the Montreal Neurological Institute, McGill University, are greatly appreciated by the authors.

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SUMARIO

El Papel de la Radioterapia en el Dominio de las Neoplasias Malignas del Cerebro y el Bulbo Raquídeo

A la irradiación terapéutica le corresponde un papel de lo más importante en el dominio de los tumores malignos del cerebro, la médula oblongada y el puente de Varolio. No es procedimiento que deba abordarse a la ligera, pues exige absoluta e íntima colaboración entre el neurocirujano y el radioterapeuta. La atención personal

diaria de parte del radiólogo, con amoldamiento del plan terapéutico al estado clínico del paciente, es de rigor.

Según han observado los AA., la irradiación ha aumentado la duración de la vida, y en bastantes casos la duración de la vida útil, habiendo aquellos tratado en un decenio (1939–1948) a 243 enfermos con tumores malignos del cerebro y el bulbo raquídeo, 13 con fibroblastomas meníngeos y 32 con adenomas hipofisarios.

Discútense con algún pormenor las varias formas neoplásicas encontradas. Las más interesantes son: (*a*) glioblastoma multiforme, (*b*) astrocitoma, y (*c*) gliomas malignos inclasificables más allá, comprendiendo estos tres grupos dos terceras partes de los tumores malignos del cerebro, la médula oblongada y el puente de Varolio.

En cuanto al glioblastoma multiforme, la duración de la vida fué ésta:

12 meses o más	47.9%
15 meses o más	29.1%
20 meses o más	22.9%
30 meses o más	8.3%

En los astrocitomas:

12 meses o más	87.8%
24 meses o más	56.1%
36 meses o más	43.9%
48 meses o más	34.0%
72 meses o más	24.3%
96 meses o más	9.7%

Los gliomas malignos inclasificados parecen quedar entre los otros dos grupos con respecto a grado de malignidad y susceptibilidad a la irradiación.

Biophysical Studies of Methods Utilizing Fluorescein and Its Derivatives to Diagnose Brain Tumors[1]

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THE CLINICAL use of sodium fluorescein as an aid in the diagnosis and localization of brain tumors has been previously documented (6, 11, 14). Briefly, the technic used at the present time is as follows: All patients subjected to craniotomy are injected immediately preceding surgery with 1.0 gram of sodium fluorescein. At operation, the cortex of the brain is examined under ultraviolet light. If a superficial tumor is present, it can be easily distinguished and its limits outlined by the presence of the yellow-green fluorescence typical of fluorescein. If the tumor is below the cortex and gives no indication of its presence on examination and palpation, brain needles are commonly used to probe for it and to obtain biospy material. With singular consistency, the presence or absence of fluorescence of the tissue fragments procured has been indicative of the presence or absence of abnormal tissue. Edematous brain tissue fluoresces slightly, and therefore, even if the surgeon does not strike the tumor directly, its proximity can be predicted by the presence of a slight fluorescence of the biopsy material. If a second biopsy taken from an area adjacent to the first reveals no fluorescence, the surgeon knows that the tumor is in the opposite direction. Among the last 104 patients suspected of having brain tumors in whom the fluorescein method was used, there were 96 with tumors which fluoresced, 8 whose tumors did not fluoresce, 6 who had no tumor and no fluorescent tissue, and only one in whom fluorescence was described and no tumor found.

Figure 1 is an operative specimen photographed with ordinary illumination. The tumor, a recurrent astrocytoma, is surrounded by a rim of normal brain tissue. Figure 2 is a photograph of the same specimen exposed to ultraviolet light; the centrally situated tumor tissue is fluorescent in contrast to the peripherally located normal brain tissue. The patient was given one gram of sodium fluorescein (5 per cent solution) one hour before operative removal of the specimen.

The 8 tumors which did not fluoresce were 3 diffuse astrocytomas in patients with long histories, 1 angioblastoma which was almost completely necrotic, 1 medulloblastoma, and 3 diagnosed as cholesteatomas. These errors represent the limitations of the procedure. These tumors, with a single exception, were benign and slow-growing.

The affinity of fluorescein for tumor tissue is not specific but can be demonstrated in any lesion of the central nervous system which breaks down the so-called "blood-brain-barrier mechanism" (BBB). Thus one would expect, as mentioned previously, that areas of brain edema would fluoresce slightly, as would the capsules of brain abscesses, granulomas, and traumatized tissue. The membranes of subdural hematomas also fluoresce. For the most part, these can be easily distinguished from the more vividly fluorescent neoplastic lesions.

Metastatic tumors, regardless of type, fluoresce brilliantly. In one instance, though there was marked necrosis of the tumor center, the rim of viable tissue was clearly fluorescent.

[1] From the Department of Surgery and Radiology, University of Minnesota Medical School, Minneapolis 14, Minn. Supported in part by grants of the National Cancer Institute, U. S. Public Health Service, the Atomic Energy Commission, and the Graduate School of the University of Minnesota. Presented at the Thirty-fifth Annual Meeting of the Radiological Society of North America, Cleveland, Ohio, Dec. 4–9, 1949.

[2] Markle Scholar in Medical Science.

Fig. 1. Photograph of a block excision of a recurrent astrocytoma, including surrounding normal brain tissue, as viewed with ordinary illumination.

Fig. 2. Photograph of the same specimen as viewed under an ultraviolet lamp. Note that the centrally situated tumor tissue is fluorescent in contrast to the normal brain tissue.

Chemical extraction was found to be too inaccurate a method for estimating the ratio of fluorescein in tumor tissue to that of normal brain. Over 50 per cent of the dye was firmly bound to protein, and the extremely low concentration in which the material is present in the central nervous system rendered analysis by conventional methods very unreliable. The striking difference in fluorescence suggested, however, that the differential concentration of fluorescein between tumor and normal brain might perhaps be great enough to make possible the clinical use of radiopaque compounds with a similar structure.

Of all the iodinated fluorescein analogues that were synthesized, tetraiodo(phthalic)-fluorescein seemed to be the only one that could be used clinically. The others were found unsuitable because of low solubility, toxicity, too deep coloration, or lack of radiopacity.

Sodium tetraiodofluorescein was accordingly given to 10 patients in whom a diagnosis of brain tumor had been made. It was administered intravenously with a Murphy drip apparatus, since it was known that nausea and vomiting resulted from rapid injection of the dye. The dosage varied from 2 to 10 gm. In 4 patients adverse reactions were encountered, consisting in nausea and chills (in 3) and thrombophlebitis at the site of injection (in 2). The former complication could probably be reduced by greater purification of the product. Undoubtedly, the thrombophlebitis resulted from the prolonged exposure of the vessel wall to such an alkaline solution (*p*H 10). No untoward reactions were encountered in those patients given 6 gm. or less of the dye.

In no instance were the roentgenologists able to demonstrate increased radiopacity of a brain tumor. In one case, a film taken one hour after injection seemed to show an area of radiopacity corresponding to the tumor site, but at operation the tumor, a meningioma, was found to contain calcified material.

Since it was known that fluorescein was largely excreted by the liver, roentgenograms of the gallbladder were obtained at various intervals after injection of the dye. In most patients, satisfactory visualization of that organ could be obtained within an hour after administration. A summary of this aspect of the study has been reported elsewhere (15).

Successful attempts were made to chelate iron and zirconium with the pyrogallol analogue of fluorescein. Similar chelations with polyalcohols were also accomplished. It was found, however, that none of these compounds were stable in physiological ranges. Of the chelated compounds that were too toxic and too unstable for even experimental use, tri-*o*-carboxy-phenylbismuthyl dichloride and combinations of barium and bismuth with various amines, such as ethylenediominetetracetic acid, are representative examples.

With these failures to utilize heavy metals, it was decided to return to the study of iodinated compounds which had the general characteristics of compounds restrained from entrance into the central nervous system by the blood-brain-barrier.

"Skiodan" (sodium iodomethane sulfonate) was made radioactive by means of an exchange reaction with radioactive iodide. When the radioactive preparation was injected into mice with brain tumors, the ratio of dye in the tumor was approximately seven times that in normal brain tissue. As much as 2 gm. per kilogram of stable dye was given to mice with large transplanted intracranial tumors, but in no instance could the tumors be visualized roentgenographically. This was to be expected, since, as will be shown later, the amount of dye necessary to provoke a distinctive shadow is relatively large.

Two patients known to have large recurrent brain tumors were given intravenously 30 gm. of diodrast over a period of forty-five minutes. Serial films were taken at one-half hour, one hour, two hours, and four hours, but in no instance was the tumor visualized.

Mono- and 3,5-diiodosalicylic acid were also synthesized. Again, the compounds were made with I^{131}, and ratios of three to

one between tumor and normal brain were found. Attempts to render experimental brain tumors radiopaque, however, ended in failure. It is interesting to note that Loberg (9), in 1929, used salicylic acid to test the blood-spinal fluid barrier of psychotic patients. Up to twenty hours after injection, the ratio of salicylic acid in the blood was usually over ten times the concentration in the spinal fluid.

Studies of the radiopacity of several zirconium-containing complexes led to an investigation of their use for our purposes, but no useful compounds were synthesized.

In order to ascertain the possibility of rendering brain tumors radiopaque by the methods outlined in the preceding paragraphs, calculations from data obtained from the distribution of radioactive dyes in tumors were undertaken.

Information is available as to the minimum amount of iodine which must be present to cast a shadow in the roentgenogram. Experimental angiography with diodrast for visualization of the cerebral circulation indicates that blood vessels about 0.5 mm. in diameter can be made suitably opaque. From calculation of the volume of such a vessel, the percentage of iodine in the radiopaque medium, and the density of iodine, the quantity of elementary iodine necessary to cast a shadow in this instance was found to be about 35 mg. per square centimeter. This figure was substantiated by Lipetz (8), who stated that the minimum quantity of iodine which can be detected by differential densitometry is approximately 50 mg. per square centimeter of the area seen on the film. For the present calculation, this figure is accepted as the minimum concentration which must be present to cast a shadow of the brain plus tumor. Since the normal brain can be assumed to contain some iodine, the figure, for our purpose, represents the differential concentration between the area containing the tumor and the surrounding area of normal brain necessary for visualization of the tumor.

From calculations published previously (10) on the counting rates to be expected from a shielded Geiger-Müller counter directed at the brain of patients injected with one millicurie of radioactive diiodofluorescein, the concentration of I^{131} in brain tissue after two hours was calculated to be 0.016 microcuries per gram. From this figure, the concentration of tetraiodofluorescein was calculated to be 0.2 mg. per gram of brain tissue when 12 grams of dye were administered intravenously. This would represent 0.12 mg. of elementary iodine per gram of tissue, since the dye contains 60 per cent iodine by weight. Assuming that the density of brain tissue approximates that of water, a brain 10 cm. in thickness would represent an iodine filter of 1.2 mg. per square centimeter.

TABLE I
CONCENTRATION OF IODINE REQUIRED TO MAKE TUMOR OPAQUE

Volume of Tumor	Diameter of Tumor	Concentration of Iodine
25 c.c.	3.6 cm.	140
40 c.c.	4.2 cm.	120
100 c.c.	5.7 cm.	88
	10 cm.	51

The required differential filter, equivalent to 50 mg. of iodine per square centimeter, will be obtained only if the tumor of a given size contains iodine in excess of the normal brain tissue in the concentrations given in Table I. If the total quantity of dye in the brain tissue can be increased without exceeding maximum toxicity levels of the body, the concentration value may be reduced.

The figures given above indicate the magnitude of the difficulties which must be overcome before radiopaque substance can be used in the manner described to delineate brain tumors. The problem may well be insoluble until substances which are highly specific for brain tumors are found and more sensitive densitometric technics are developed.

The unsuccessful efforts to synthesize radiopaque compounds which would aid in the localization of brain tumors stimulated an investigation of the use of radioactive substances. In the initial studies, sodium diiodofluorescein (DIF*) was synthesized

to contain I^{131} (radioactive compound indicated by*). Radioactive iodine was chosen because (1) fluorescein can be iodinated in one step, necessitating a minimal number of manipulations, (2) it has a half-life of eight days, and (3) it emits a penetrating gamma ray (0.367, 0.638 mev) which can be detected through the skull. The synthesis of radioactive diiodofluorescein has been previously reported, (2), but an improved method since developed by Dr. D. L. Tabern has resulted in a much purer product.[3]

Following a preliminary publication (12) concerning the use of DIF* to localize brain tumors (12 patients), Marvin and Moore (10) reported a study of some of the physical limitations of such a technic. In order to simulate the clinical conditions, a human calvarium was filled with a solution of I^{131} containing an amount of activity similar to that found in normal brain tissue. A 40 c.c. thin-walled, round glass flask was used to simulate brain tumor and was filled with I^{131} to give various levels of activity. It was concluded that brain tumors containing a concentration of radioactive dye twice that of the surrounding normal brain could be detected if their volume exceeded 20 c.c. If greater ratios of activity were present in the tumor, tumors of smaller volume could be detected. This has subsequently been proved true in clinical studies. It is even more favorable that the edematous tissue which often surrounds brain tumors takes up an appreciable amount of dye and thus adds to the effective volume of the tumor.

The experiments also indicated the necessity of obtaining high enough total counts for each position so that the statistical fluctuation in the counting rate obtained would be no higher than a fraction of the 10 to 20 per cent increase in the total count contributed by the presence of the brain tumor.

Subsequently, an additional 77 patients suspected of having brain tumors have been examined with the radioactive diiodofluorescein method (13). The dosage employed was not more than 1.5 mc. (standard adopted July 1, 1949) contained in 60 to 125 mg. of dye. After intravenous injection of DIF*, the activity over symmetrical areas of the head was measured with a single shielded end-window type Geiger-Müller counter, beginning one-half hour after injection. The counting rates for each area per unit time were then compared for localization of the tumor. Since the blood level of the dye is much higher than the tissue levels for a short time after injection, care must be exercised that counts are not taken over the large venous sinuses. In addition, since the greatest concentration of the dye in the body is found in the liver (later the gallbladder), the tube should be directed away from the liver; in obtaining counts over the vertex, the head must always be interposed between the tube and the liver. To reduce the effect of the high activity in the latter organ, a yoke-like lead shield which fits around the neck can be used.

When a single counter is used, the symmetrical areas to be compared should be measured one after the other. This is necessary because the general level of activity slowly drops. If too great an interval intervenes, the area counted later will always have a lower activity. This deficiency is being corrected by using multiple counters, by which the activity of symmetrical areas can be determined during the same interval of time.

The easiest tumors to localize were the more malignant types (glioblastoma multiforme), which were known to take up the greatest amount of dye. Those tumors accompanied by brain edema were also found with comparative ease. Parasagittal meningiomas situated close to the skull could be detected readily. Tumors less than 3 cm. in diameter, unaccompanied by a halo of edematous tissue, were more often missed. Tumors of the posterior fossa (particularly in the midline) and of the parasellar area were difficult to find. Pituitary tumors could not be localized. This, however, was not surprising since it

[3] At present being obtained from Abbott Laboratories, North Chicago, Ill.

TABLE II

RATIO OF DIODOFLUORESCEIN IN TUMOR AND "NORMAL" BRAIN

Glioblastoma multiforme	28.0:1
Ependymoma	19.3:1
Meningioma	5.0:1
Ependymoblastoma	4.0:1
Metastatic tumor	3.3:1
Acoustic neuroma	2.3:1
Astrocytoma	2.0:1

was known that they take up very little dye. Acoustic neuromas did not seem to contain enough dye to expedite their localization. Table II shows the maximum ratio of dye found in various tumors as compared to the activity of adjacent "normal" brain tissue.

In most instances, the specimens of "normal" brain were actually edematous or the site of gliosis and, therefore, contained more dye than normal brain tissue. Thus the ratios listed in Table II cannot be considered maximal, though they do give indications of the differential concentrations with which one has to work.

In order to clarify further the limitations of the DIF* method and for evaluation of several detector-shield units, methods of measuring, and the clinical efficacy of scintillation counters, preliminary studies were performed with rectangular water baths containing tumors represented by spherical glass or latex containers. More complete analyses, especially of counting methods, demand the use of a brain phantom enclosed in a skull. A convenient method of making such a phantom is with Unna's paste, which is readily available from the hospital pharmacy. The melted paste is mixed with a sufficient quantity of I^{131} to give a "brain activity" similar to that found clinically, and then poured into a human calvarium and allowed to jell. Similarly, phantom brain tumors with volumes of 20 c.c. and 40 c.c. were made of the paste and enough I^{131} added to give levels of activity two, three, five, and ten times that of the phantom brain. This type of phantom simulates closely the actual conditions, and has the added advantage that it can be manipulated freely without danger of radioactive contamination of the laboratory or detecting apparatus which is always present with water phantoms. Measurements revealed that the paste absorbed the gamma radiation of iodine in a manner identical to water. It was assumed, therefore, that the absorption characteristics of such a phantom were similar to those of brain tissue.

The effect of detector geometry and shielding becomes a factor in the ultimate accuracy as well as in the localizational characteristics of the brain tumor analysis. One of the most important considerations is the actual counting rate of gamma rays emitted from the dye within the skull as compared to the allowable time period during which the measurement can be made. Due to the statistical law of random counting, the longer the counting period, the closer the counted number of gamma rays comes to the real counting rate. If the counting rate is small, then the time of measurement must be greater than if the counting rate is large, for the same expected accuracy.

The use of a "wide open" detector or unshielded mica window Geiger-Müller tube, while advantageous from the standpoint of a gross counting rate, requires a number of counting positions all surveying the region of the tumor's radioactivity contribution in order to obtain an accurate integrational indication of its location. This is, in all probability, because the detection area of the Geiger-Müller tube is as large or larger than the tumor. A surface tumor can be easily detected with this counter set-up by utilizing the method of symmetrical positions, but detection of a tumor at a depth will be difficult. This type of counter does find a use for rapid "scanning" of the head in order to point out areas which can be surveyed more closely by other methods.

The "narrow" or well shielded directional detector, because of the lower counting rate, requires a consideration of the time-function but has the advantage of a more positive localizational characteristic A mica window counter with the shielding extending 7 cm. beyond the window was good for locating deeper situated tumors.

In fact, an increase in the counting rate due to the presence of a tumor in the opposite hemisphere could be detected.

Other modifications to increase the directional characteristic of the Geiger-Müller counter, such as the use of a modified Lysholm grid, did reduce the spread of the "detection cone" but also seriously reduced the counting rate.

In summary, the investigation of different types of Geiger-Müller tubes and shields has shown that a compromise must be obtained between a detector-shield geometry, which allows satisfactory directional properties with the active region of the detector as close as possible to the end of the shield, and one which, in order to obtain the directivity, places the active region at some distance within the shield. The studies have indicated that there is an optimum detector shield condition for each stipulated time for measuring, and that the shield not only determines the differential localization characteristics of the detector unit but also limits the maximum counting rate.

In view of the physical considerations involved in a complete survey of the head, three practical systems of measuring reference, or detector positioning, were investigated. The *circular method* maintains the detector distance from the origin of the reference constant, with the axes of the detector positions intersecting an imaginary common point (origin) which lies within the skull. The *"normal"* method of positioning is an obvious derivative of a circular or polar co-ordinate system of reference, with the detector placed in contact with the skull with its geometrical axis normal to the skull at the point of contact. The third method of detector positioning using *rectangular co-ordinates* has been investigated by others (5). The mechanical simplicity of this system has led us to compare it with the circular and normal methods as to possible advantages for clinical use.

If the circular method were conducted about a true sphere containing a homogeneous mixture of radioactivity, the counting rate would be constant, since the distribution of radioactivity in the skull, as viewed by the detector, closely resembles a sphere. The actual deviation in the count rate curve from the theoretical straight line was small. This allowed easy detection of distortion of the curves due to a focus of increased activity contributed by a tumor. On the other hand, with the rectangular system of positioning, the count rate curve must deviate markedly, since the detector will necessarily be a greater distance from the source of radioactivity as the extremes of the survey are reached. It was also noted that with the rectangular system, the sensitivity ratio[4] changed greatly as the measuring plane of the detector was raised or lowered. Thus one of the greatest disadvantages of the rectangular system of analysis is that the detection of a tumor must involve a comparison with a normal curve, which, in actual practice, may be difficult to obtain. The distortion of count rate curves from the normal by the increased level of activity contributed by the tumor is especially difficult to see when it occurs on curves with steep slopes such as are inherent in the system. The "normal" method of detector positioning maintains all of the advantages of the circular system and, in addition, allows for slightly greater counting rates by virtue of the fact that the detector is closer to the skull.

The differential method of analysis (comparison of symmetrical areas bilaterally) eliminates the necessity for the establishment of normal count rate curves. Most skulls are symmetrical enough, compared right to left, when detectors are placed symmetrically on each side of the skull. They will register equal counting rates for a non-tumorous situation. If the entire skull is surveyed with detectors in symmetrical positions, the presence of additional radioactivity is assumed whenever the counting rates of the two positions differ.

[4] The sensitivity ratio may be defined as the ratio of the amount of tumor radioactivity to the total amount of radioactivity in the directional field pattern of the detector-shield.

The differential method of analysis is possible with the rectangular method, but with the detector at such distances as to accommodate a rectangular survey, the loss in time-function accuracy due to the decreased counting rate is an adverse characteristic.

It has been concluded from phantom studies that the "normal" method of detector positioning holds the most promise as a simple reliable system. The differential type of analysis, utilizing a comparison of data obtained from symmetrical positions, has been proved reliable in clinical use, provided that reasonably accurate symmetrical positioning is used.

It was early learned that, with the use of only one counter, an adequate survey of the head would take at least two hours; and since, as mentioned previously, the level of activity over the head gradually decreases, increased counting time intervals had to be employed in order to obtain significant results. An obvious answer to this problem was the development of a multiple detector set-up.

An indispensable auxiliary to the use of multiple detectors is some type of mechanical mounting so as to allow accurate, reproducible positioning over symmetrical areas. One such device now undergoing clinical trial consists of two symmetrical elliptical arc segments, each with four cylindrical sleeves in which the shielded Geiger-Müller tubes are inserted. When the tubes are mounted, their respective axes intersect at one point which, when the patient is in position, lies in the center of the skull. The elliptical segments are on an axis which passes through the midline of the forehead to the occiput. With the segments mounted on bearings, each detector bank can be moved to include any level of survey, from a situation in which the eight detector units are arranged in a single plane along Reid's base line to the other extreme, in which the pairs of detector units are side by side in nearly parallel vertical planes passing through the head on each side of the midline. The scalers in use at present are of a standard commercial model decade type. Use of decade scalers obviates the necessary interpolation of each scaler when the "scale of 64" type is used. In combining the scalers with a control circuit for automatic, simultaneous starting and stopping of the counting circuits, it was found that the use of a vacuum tube type switch was mandatory in order to eliminate switching transients which sometimes registered false counts on the scalers.

In order to avoid the necessity of giving higher doses of radioactivity to insure the accuracy and validity of the radio dye method, investigations were conducted to find, if possible, instruments with greater efficiencies for detecting low-energy gamma rays. The upper practical limit of efficiency in detecting the gamma rays of I^{131} with conventional Geiger-Müller counters has been about 2 per cent. It was hoped that scintillation type counters could possibly be modified for clinical use, since it was known that their theoretical efficiency was much higher.

The problem of adapting the scintillation counter for clinical use is an extremely difficult one technically. I^{131}, with its 0.36 and 0.63 mev gamma rays, produces a light pulse in anthracene which, when detected and amplified by the photomultiplier tube, does not differ greatly in its characteristics from the tube noise pulses. Unfortunately, the photomultiplier tube, which converts the light pulse (scintillation) into an electrical current pulse, has inherently a rather high noise level. The noise pulses arise spontaneously as a result of the low work function of the metal compound which constitutes the photosensitive surfaces of the photomultiplier tube elements. The rate at which these noise pulses are generated is many times greater than the actual counting rate of scintillations. This makes their presence intolerable.

The conventional method of preventing the counting of noise pulses by the scaler is to discriminate between the tube noise and signal pulses on an amplitude basis by using the proper choice of amplifier time decrement for optimum performance.

The use of refrigerants upon the photomultiplier tubes to reduce the noise pulse rate has been regarded as impractical from a clinical point of view. At present, a coincident method for noise reduction is being used, and by this means, very satisfactory results have been achieved.

Due to incomplete energy conversions in the phosphor as well as statistical fluctuations in the secondary emission factor and photo-cathode conversion efficiency, a number of scintillations are not counted, because they fall below the acceptance of the discriminator. As was expected, an increase in efficiency may be realized by operating with a high background of noise pulses. With a small single crystal of anthracene, an absolute efficiency (for counting the 1.3 mev gamma rays of Co^{60} of 18 per cent was obtained with a background of 1,300 noise pulses per minute. This figure is quoted to illustrate the maximum efficiency that may be realizable for our use if some method is found to reduce the noise rate to a negligible value of less than 30 counts per minute.

In actual practice the anthracene scintillation counter has been operated at the following levels; calibration with Co^{60}:

Background.....	50 c.p.m.
Absolute efficiency...	10.2 per cent
Background.....	1 c.p.m.
Absolute efficiency...	6.5 per cent

A further illustration of the capabilities of the scintillation counter is evidenced by an absolute efficiency for I^{131} of three times that of a Thyrode tube. With a detection volumetric ratio of 40 to 1 between the Thyrode tube and the crystal, the non-corrected efficiencies of the two are equal.

Physical constructional details associated with scintillation counters make them ideal for shielding with a minimum weight. Because of the high-energy conversion efficiencies of solid phosphors, the detection area and volume may be made very small. Single anthracene crystals with a detection area of 3 sq. mm. can be satisfactorily employed by using the coincident application of 1P21 photomultiplier tubes.

An example of the field pattern easily obtainable with the scintillation counter is one where the crystal was placed at the end of lead slit with a width equal to that of the crystal (0.5 mm.). At a distance of 20 cm. from the crystal, using a point source of radioactivity, the width (perpendicular to the line of the center of the slit) over which the count rate was 50 per cent or more of the maximum count rate was still 0.5 mm.; the 10 per cent width, 2 cm.

Electronic aspects of the scintillation counter are good, and at the extremely low light levels at which the photomultiplier tubes are used, there is a satisfactory stability. With the advent of the newer higher gain photomultiplier tubes now in development, the associated electronic equipment tends more and more to simplicity. A specially constructed photomultiplier tube with a small photo-cathode would, indeed, solve much of the noise problem in this type of scintillation counter application.

We have not had an opportunity to determine which of the commonly used phosphors will present the best characteristics for our application. Anthracene has been used because of its non-critical physical characteristics and reasonably long scintillation time (0.05 micro-second).

It can be concluded that experiments to date fully justify continued investigation of scintillation counters for clinical use.

No discussion of the clinical use of compounds containing radioactive isotopes would be complete without indication of their fate in the body and their rate and route of excretion. After preliminary studies in dogs, tracer amounts of radioactive DIF* were administered intravenously to patients with a diagnosis of cancer. Blood samples were taken at ten minutes, thirty minutes, one, two, three, six, nine, and twenty-four hours after injection. All of the urine and feces, whenever possible, were collected for the following three or four days.

The disappearance of the DIF* from the blood stream is depicted in Figure 3. It can be seen that in patients without evi

dent liver damage or biliary obstruction, the serum level of DIF* has dropped to 50 per cent of the initial level in one hour, and to less than 10 per cent in ten hours. The average blood level at twenty-four hours was approximately 4 per cent of the initial level following injection. However, in two patients with proved cirrhosis of the liver (biopsy through peritoneoscope), the serum DIF* level at twenty-four hours was twice that of the above control group.

TABLE III: EXCRETION OF DIIODOFLUORESCEIN IN URINE AND FECES (PERCENTAGE OF DOSE)

	Urine	Feces		
Day	Average	Minimum	Maximum	Average
1st	9.5	0	33	16.5
2d	3.4	0	28	12.2
3d	1.8	0	55	15.0
4th		0	51	27.4
Total	14.7	0	..	71.1

Four patients with carcinoma of the head of the pancreas and, as a result, complete obstruction of the biliary tract, showed a much slower drop in blood concentration of the dye. At the end of twenty-four hours, their average blood level of DIF* was over five times higher than that of the normal group. This confirmed earlier studies which showed that, in the dog at least, about 85 per cent of the dye is excreted by the liver into the biliary tract within five hours after injection.

From the foregoing discussion, it is apparent that, unless reabsorbed by the intestines, most of the DIF* would be found in the feces. This was substantiated by studying the excreta of patients with brain tumors who were subjected to the radio dye technic. The study included 20 patients who were operated upon one day after receiving DIF* and who were considered to have essentially normal hepatic and renal function (Table III).

It must be remembered that many of the patients did not have a bowel movement during the first or second day postoperatively. For example, one patient had no bowel movements for three days, then on the fourth day excreted in the stool 51 per cent of the dye injected. In such cases,

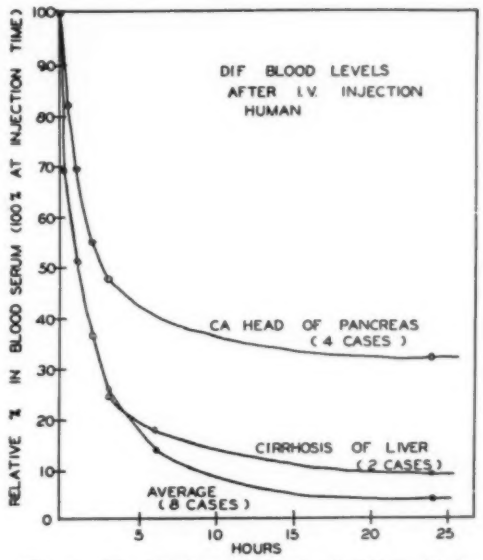

Fig. 3. The blood serum levels of sodium diiodofluorescein following intravenous injection of the dye.

the movement of the radioactive dye could be traced as it passed through the small bowel and colon. Even in those patients in whom the dye was retained for several days in the large bowel, there was little increase in the amount excreted in the urine. When more vigorous attempts were made to get the dye excreted quickly per rectum, as much as 85 per cent of the amount injected was recovered from the feces in seventy-two hours.

Figure 4 depicts the rate of excretion of diiodofluorescein in the urine. Curves 1, 2, and 3 represent variations in the urinary excretion of "normal" patients. Note that one patient with cirrhosis of the liver (curve 4) excreted much more dye in the urine. Even more striking were the urinary excretion curves of patients with complete biliary obstruction. It was found that practically 100 per cent of the injected dye could be recovered from their urine in ninety-six hours (curve 5).

It is evident, therefore, that the main route of excretion of diiodofluorescein is by way of the liver, bile, and finally the gastro-intestinal tract. Normally, about 15 per cent of the dye will be excreted by the kidneys and 75 per cent in the

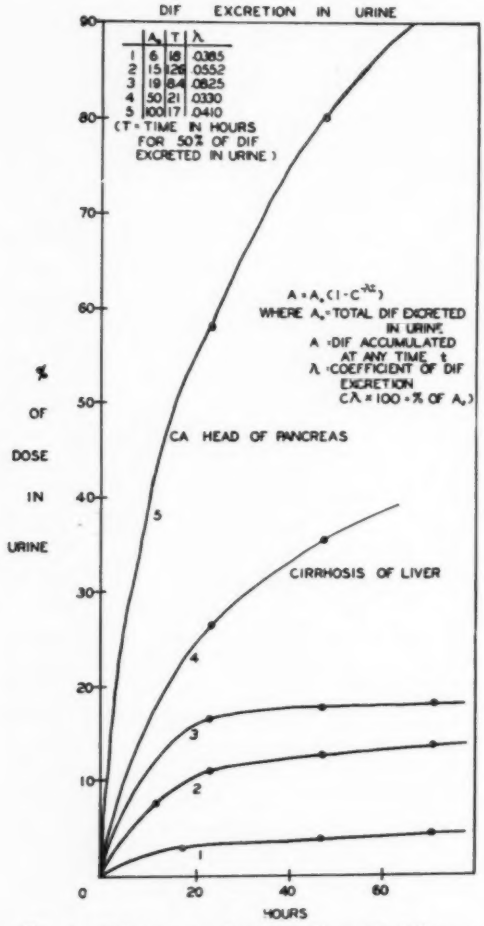

Fig. 4. Urinary excretion of sodium diiodofluorescein. Curves 1, 2, and 3 represent the excretion rate of patients with normal hepatic and renal function; Curve 2 is the average rate of 8 patients; Curve 4 shows the excretion rate of 2 patients with cirrhosis of the liver; Curve 5, the average excretion rate of 4 patients with complete obstruction of the biliary tract.

feces. It is important to note that if excretion by means of the biliary system is blocked, the dye can still be excreted by the kidneys in a reasonable time, thus affording a safety factor. An interesting sidelight was the diagnosis of gallbladder function. If a Geiger-Müller counter was moved over the liver between thirty minutes and two hours after injection of DIF*, the gallbladder could be easily located by its higher level of activity. If no area of higher activity was encountered, it could be assumed that the gallbladder was non-functional. In two instances, diagnosis of a non-functioning gallbladder by this method was confirmed by operation.

Perhaps the greatest danger of the clinical use of radioactive iodine-containing compounds is the possibility of the iodine being split off and subsequently being taken up by the thyroid gland. The radioactive diiodofluorescein originally made by the Minnesota group was known to contain minute quantities of other iodination products, such as mono-, tri-, and tetraiodofluorescein. This original dye did release enough free iodine upon autoclaving so that minute but measurable quantities of I^{131} were found in the thyroids of some patients receiving the dye. In no instance, however, did the amount of activity in the entire gland exceed 8 microcuries. Radioactive iodine was also detected in the thyroid glands of dogs given DIF* (made by the original method) either intravenously or into the stomach by intubation.

As mentioned previously, D. L. Tabern of Abbott Laboratories has synthesized a much more purified DIF*. Preliminary studies upon mice, 3 dogs, and later 3 patients have been very gratifying. No radioactivity has been detected in the thyroid glands of either patients or animals. Excretion of this dye by the liver and kidney is the same as that of the original dye.

The biological half-life of DIF* in the liver was found to be twenty to thirty hours. The total dose of radioactivity to the liver was calculated to be approximately 8.5 equivalent roentgens (e.r.).

If one would like more assurance that no I^{131} would be taken up by the thyroid, Lugol's solution could be administered to the patient for several days previous to the administration of DIF*. With the development of the more stable DIF*, this precaution has not been deemed necessary.

DISCUSSION

At this clinic, sodium fluorescein has proved to be a valuable aid in determining the presence or absence of abnormal brain tissue in needle biopsy material. The

accuracy of this method is about 95 per cent. Metastatic tumors were found to take up fluorescein as well as primary tumors of the brain. In general, the degree of fluorescence appeared to parallel the degree of malignancy.

The affinity of fluorescein for tumor tissue is not specific. Areas of brain edema, brain abscesses, subdural hematoma membranes, granulomas, and traumatized tissue will all take up more fluorescein than normal brain. It would seem that the concentration of dye in abnormal brain tissue is related to the breakdown in the affected areas of the so-called blood-brain-barrier (BBB). This phenomenon (BBB) was proposed to explain the selective passage of certain substances from the blood into the central nervous system. As a result of numerous investigations (3, 4, 7)—far too many to review here—it was determined that the most important single factor in determining the passage or lack of passage of compounds into the central nervous system was the electrical charge of the substance in question (7).

Experiments have confirmed the fact that most ions with a negative charge do not pass as quickly into the central nervous system. The classical work of Goldmann (4) in 1913, utilizing acid and basic dyestuffs, is still relevant today. More recently Broman (3) has extensively studied the permeability of the cerebrospinal vessels in normal and pathological conditions. He has concluded that the site of the BBB is in the intima of the capillaries of the central nervous system.

Since sodium fluorescein is an acid dye the chromagen portion of the molecule carries a negative charge. Thus, fluorescein could not be expected to penetrate into normal brain tissue; on the other hand, it could concentrate in areas in which the BBB is broken down. Apparently the vessels supplying brain tumors do not have the barrier mechanism. For this reason, a differential concentration of negatively charged compounds obtains between neoplastic tissue and the surrounding normal brain.

The practicability of using the BBB mechanism has been illustrated in this paper by the fluorescein test and the use of radioactive diiodofluorescein. Whether it will be possible to utilize it for other clinical procedures is not known. In this report, the failure to employ the BBB mechanism successfully in attempts to render brain tumors opaque to roentgen examination may not represent the limitations of the phenomenon. Perhaps future work will disclose compounds better suited to take advantage of the BBB, or methods which will increase the BBB of normal tissue. It is interesting to note that Ashkenazy (1) has found that the previous exposure of the brain to deep x-ray therapy seems to increase the accuracy of localization of brain tumors with the radioactive diiodofluorescein method by preferentially increasing the amount of dye in the tumor area.

The essential clinical value of the radioactive diiodofluorescein method of diagnosing tumors cannot be determined at the present time. At present, the method has not been accurate enough for complete dependence upon it.

From the Veterans Administration Hospital, Hines, Ill., Ashkenazy (1) has recently reported a series of 60 patients in which an accurate diagnosis and exact localization of the tumor was obtained in 94 per cent. Only one falsely positive conclusion resulted from the DIF* method.

In contrast to these consistent results, lesser degrees of diagnostic accuracy and localization were obtained in the same group of patients by clinical signs, electroencephalographic studies, and air studies (pneumoencephalography and ventriculography). Ashkenazy also indicated that more malignant tumors seemed to retain the most dye and for longer intervals. As regards technic, an end-window Geiger-Müller tube provided with an appropriate aluminum shield to eliminate beta radiation and enclosed in a 1.2 cm. lead shield was used. The impulses were registered by a counting rate meter and graphically traced by a recording milliammeter.

The excellent results obtained by Ashkenazy and his co-workers probably represent as great an accuracy as can be obtained with the DIF* method.

As pointed out earlier, certain tumors seemingly do not take up enough dye, while other tumors, especially of the posterior fossa, may be too small to contribute enough activity to be detected above the background level of activity of the brain. However, the development of more precise and efficient instrumentation, a better knowledge of means of localizing radioactivity emanating from the body, and an increased understanding of the underlying biological phenomena should lead to a more valid test.

SUMMARY

1. With the use of sodium fluorescein, differences between normal and neoplastic brain tissues are accentuated, thus affording the neurosurgeon a better chance of diagnosing and localizing brain tumors.

2. Sodium fluorescein is also of value in studying non-neoplastic lesions of the central nervous system.

3. Attempts to render brain tumors radiopaque by the selective retention of radiopaque compounds were unsuccessful.

4. The use of radioactive diiodofluorescein for the diagnosis and localization of brain tumors has proved feasible. Clinical studies revealed inherent weaknesses in the method, such as the size of tumor that could be detected, and the failure of certain tumors to retain a sufficient quantity of dye to make their detection practicable.

5. Studies to demonstrate the possibility of improving the instrumentation of such a technic are outlined. The development of the scintillation counter and its advantages and limitations are sketched.

6. Studies of the excretion of radioactive diiodofluorescein revealed tha tmost of the dye is excreted in the bile and can be recovered from the feces. In patients with biliary obstruction, the dye is excreted wholly in the urine.

7. It was indicated that there is little danger of I^{131} splitting off from the dye, and with a stable product no activity was found over the thyroid gland.

NOTE: The authors wish to express their appreciation to Professor K. W. Stenstrom of the Department of Radiology and Professors W. T. Peyton and L. French of the Division of Neurosurgery for their active interest in these studies; also to Miss J. L. Maul for technical assistance.

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SUMARIO

Estudios Biofísicos de las Técnicas que Utilizan la Fluoresceína y los Derivados de la Misma para el Diagnóstico de los Tumores Cerebrales

La fluoresceína sódica ha resultado ser un auxiliar valioso para determinar la presencia o ausencia de tejido anómalo en el material obtenido en la biopsia acicular del cerebro. Tras la inyección de 1.0 gramo de fluoresceína sódica los tumores tanto metastáticos cuanto primarios mostraron una fluorescencia típica, correspondiendo por lo general en intensidad a la malignidad del tumor. Manifestaron fluorescencia en menores grados el tejido cerebral edematizado, los abscesos cerebrales, las membranas del hematoma cerebral, los granulomas y el tejido cerebral traumatizado. Este depósito selectivo de fluoresceína es atribuído a una desintegración del mecanismo de la llamada valla hemoencefálica.

Las precedentes observaciones indicaban la posibilidad de convertir un tumor cerebral en observable roentgenológicamente por virtud de la retención selectiva de un compuesto radioopaco, pero fracasaron todos los esfuerzos realizados en dicho sentido.

Emprendiéronse entonces estudios relativos al empleo de sustancias radioactivas para la localización de los tumores. Para este fin se usaron diyodofluoresceína radioactiva y en el cráneo un contador de Geiger-Müller para localizar las zonas de mayor concentración del colorante radioactivo. Descubiertas ciertas limitaciones de esta técnica, lleváronse a cabo nuevos experimentos con cuentachispas que, según se sabe, poseen una eficacia teórica mucho mayor que la del aparato de Geiger-Müller. Los resultados de este estudio indican que está justificada la continuación de las investigaciones de los cuentachispas para empleo clínico.

Por fin, se estudiaron la velocidad y la forma de la excreción de la diyodofluoresceína sódica, del organismo. Descubrióse que la principal vía de excreción es por el hígado, la bilis, y por fin el tubo gastrointestinal. Normalmente, excrétanse aproximadamente 75 por ciento del colorante en las heces y 15 por ciento en la orina. En presencia de obstrucción biliar, el colorante es excretado por completo en la orina. De paso, pudo localizarse la vesícula biliar con el aparato de Geiger-Müller entre treinta minutos y dos horas después de la inyección endovenosa del medio.

Parece que hay poco riesgo de que se desprenda el yodo radioactivo de la diyodofluoresceína y se absorba en el tiroides. Con una forma purificada recién sintetizada, no se descubrió radioactividad sobre el tiroides.

DISCUSSION

(Papers by Young; Camp[1]; List; Hodges; Peirce and Bouchard; Moore et al)

Spencer Braden, M.D. (Cleveland, Ohio): At least some of the difficulties in the recognition, diagnosis, and management of cranial and intracranial neoplastic and vascular problems could be no better attested to than by the nature and variety of the very excellent material presented in this Symposium by a group of distinguished workers. I should like to begin with words of commendation for the excellence of their respective efforts. Perhaps no better example is to be furnished of the value of close teamwork than in problems of this nature, and the roentgenologist will remain a neurosurgeon's staunch ally.

Time and the extent of the material do not permit an adequate and critical analysis of each subject, but perhaps a few points of emphasis should be made and certain warnings sounded. With this in mind I should like to proceed with the essays in order.

Roentgen Manifestations of Tumors of the Skull, by Barton R. Young: It is assumed that conventional roentgenograms of the skull are meant to include anteroposterior and lateral stereoscopic films

[1] To be published later.

as well as tangential views when indicated. If not, this point should be stressed, since not infrequently the lesion can be demonstrated in only one of many different projections.

The value of stereoscopic views in judging the degree of intracranial extension in calcium-producing lesions is obvious and needs no comment other than that the extent of the calcium does not always indicate the actual extent or limitations of the tumor.

Finally, there is certain inherent danger, at least in my experience, in attempting roentgenographically to establish or prophesy the etiology of cranial lesions, and this more especially in those producing sharply marginated areas of rarefaction. In many instances, the differential diagnosis between carcinoma, either primary or metastatic, myeloma, eosinophilic granuloma, and even in rare instances meningioma, must necessarily be established by biopsy or operative exposure.

The Roentgenologic Significance of Intracranial Calcification, by John D. Camp: If it is old-fashioned to keep from warning or from upsetting an entire house staff, and more especially a family, because of the roentgen demonstration of an intracranial calcification which on the one hand may be nonexistent, because of extrinsic factors, and on the other hand may represent a physiological process, this has served a very useful purpose. Dr. Camp has a very high batting average, at least in my estimation, in demonstration of the pineal shift, and this obviously denotes that he has a considerable interest in this phase of the particular problem of localization. He has at least, I would consider, a rather higher than average batting average in etiologic diagnosis.

Cerebral Angiography, by Carl F. List: By virtue of his extensive experience, there is perhaps no one better qualified to evaluate the subject of cerebral angiography than Dr. List. He has dealt very adequately and very completely with all the seemingly significant points. The value of this procedure in recognizing and ultimately treating intracranial vascular lesions cannot be over-emphasized. Its superiority to any other method in these specific lesions is generally well recognized. Its shortcomings have been mentioned. My own experience with its use in intracranial neoplasms has not been extensive and my inclination in these particular lesions is toward ventriculography or occasionally encephalography. Unless one has had extensive experience with the use of angiography in neoplasms, he is treading on dangerous ground so far as localization is concerned and even more dangerous when it comes to etiology.

Cerebral Aerography, by Fred J. Hodges: Some of you may know that I went to "pneumographic grammar school" under Dr. Hodges. Most of the essayists contributing to this symposium sent me their papers. He didn't—I thought possibly for a particular reason. I was fearful lest he was going to come down here and tell me something that was going on that I didn't know about. All I learned about pneumography I learned at the University of Michigan in Dr. Hodges' department.

I can only say I acquiesce entirely in his feelings on the matter relative to the utilization of encephalograms as well as the indications for ventriculography.

Role of Radiation Therapy in the Control of Malignant Neoplasms in the Brain and Brain Stem, by Carleton B. Peirce: I regret that my own less extensive statistics are not available for comparison with those of Dr. Peirce in cases of irradiated cerebral neoplasms, but it is my reasonably certain impression that they would fall far below those presented. Dr. Peirce is to be congratulated for carrying on with what might seem to some a rather hopeless and unrewarding effort. The neurosurgeon takes a special delight and pride in those lesions which lend themselves to total extirpation. He is all too aware of the other group in which, possibly for a number of reasons, his hands may be tied. His willingness and desire to recommend and utilize the benefits of irradiation therapy are an admission of his partial defeat in these problems.

It is not within my province to discuss dosage and the method of irradiation therapy. The cooperation of the radiologist and surgeon in the neurological, cytological, and roentgenographic evaluation represents the only valid approach to this difficult problem. The ultimate answer will necessarily be found in more studies of this nature. I note with interest the fact that no cytologic evidence of damage to normal brain is recorded. I think I recall clearly hearing Dr. Percival Bailey state several years ago that it did occur. Perhaps it is a matter of dosage.

Biophysical Studies of Methods Utilizing Fluorescein and Its Derivatives to Diagnose Brain Tumors, by G. E. Moore: The use of fluorescein and its derivatives is a new and exceedingly interesting developmental adjunct to an already increasing armamentarium. I am unable to comment, by virtue of any experience, on this newborn, but I am tremendously intrigued by it. Despite its limitations and shortcomings in its present state of development, it appears that with further experience a greater degree of perfection is to be expected in locating and more accurately defining the extent of an expanding intracranial lesion. It was not brought out in Dr. Moore's remarks, but in the paper which he sent me he mentioned difficulty in localizing tumors of certain histologic nature and of certain size. This is especially hoped to be true of the non-encapsulated type. The limits imposed on the surgeon in the attempt to remove such lesions, by virtue of their contiguity to important functional structures, needs no mention.

With respect to this procedure I should like to inquire whether or not the attempt has been made to utilize this material in combination with any of the innocuous dyes, such as Nile blue, as a possible

further help in establishing tumor limits by gross inspection as well as radioactivity.

The use of electroencephalography, especially in those patients with surface lesions which produce irritative or convulsive symptoms, deserves to be included, and frequently in good hands serves a definite and useful purpose.

In conclusion, we are confronted with a vast array of varying procedures which are directed toward a common goal. To utilize them all in a given case is not necessary nor the object. The 8-gauge shotgun is illegal. What is best in a specific instance may be valueless in another. An approach to the ideal would then seem to have to be based on a careful and, if necessary, repeated historical and neurological evaluation of the particular problem at hand in an effort to determine which one or which possible combination of procedures is likely to contribute the most to the desired knowledge. The wise policy would seem to start with the least, and when necessary to end up with the most.

Wendell G. Scott, M.D. (St. Louis, Mo.): After these splendid papers and the comprehensive discussion by Dr. Braden, it hardly seems possible to add much to this instructive and fascinating symposium. My discussion will be largely limited to the point of view of the radiologist. In this connection Dr. Young has presented us with an excellent collection and review of tumors of the cranium with a thorough discussion of their characteristic appearances. At times they are not as easy to distinguish and differentiate as he has demonstrated. The important point he emphasized was the fact that the routine lateral stereoscopic views and the anteroposterior view of the skull are no longer adequate in the examination of the patient with an intracranial lesion. We must examine each patient first and then determine what views are necessary for thorough investigation of the area in question.

Dr. John Camp has given us another of his classic lectures on intracranial calcifications. I marvel how he can always find new information and new significance in the interpretation of these calcific deposits. As Dr. Braden has mentioned, they form the key to the original diagnosis of lesions of the skull or intracranial contents and oftentimes they establish the diagnosis so that further procedures are not indicated.

I welcome this opportunity to pay tribute to Dr. List, who was one of the early pioneers in the development of cerebral angiography. I don't believe there is anyone in this audience who doubts now that cerebral angiography has come of age. This is another example in which a related specialty has gone ahead with a new procedure and has brought to the radiologist the problem of arriving at a satisfactory method with perfection of the technic. We feel that this has now been accomplished by the mechanization and automatization of radiographic equipment to render an adequate series of films showing the bolus of opaque material circulating through the cerebral arterial and venous tree. This new equipment has helped to make angiographic procedures more practical and safer because it is now possible to use smaller amounts of the opaque material and to avoid repeated injections.

I was glad that Dr. List mentioned that thorotrast is no longer considered an ideal medium for cerebral angiography. I should like to go even further and say it should not be used because, in addition to its radioactivity, this material, when injected into the tissues of the neck, is known to produce a serious and disfiguring fibrosis. It should certainly never be used by the percutaneous method.

I should like to ask Dr. List if he could tell us about how frequently he is using the percutaneous method with respect to the frequency with which he does an open or direct injection? With the use of mechanized radiographic equipment, we are finding that this method holds more attraction for our neurosurgeons and they are employing it in about two-thirds of the instances where formerly it accounted for only about one-third or one-fourth of the injections.

It is difficult to add anything to Dr. Hodges' splendid demonstration on ventriculography and encephalography. He has brought us up to date in these two standard procedures. He did use one new term, "aerography" for these procedures.

Dr. Carleton Peirce has presented an excellent survey of his treatment of malignant neoplasms of the brain and brain stem. He sent me a copy of his paper before this meeting and I tried to review some of our statistics and found that I couldn't make a reliable comparison with his material. At the same time, I found we were not achieving as effective results as pointed out by Dr. Peirce, partly because we were not delivering as large a dosage to the brain tumors. We were staying below 5,000 r to the tumor, while he reaches 9,000 r.

Another factor that might have influenced his results to some extent is the great improvement in the surgical technics and technics of anesthesia, and for this reason we should make a little allowance for Penfield's 1935 series as compared to a series at the present time. Nevertheless, I feel inspired to make better efforts in our treatment of malignant tumors of the brain. I was pleased to hear Dr. Peirce say we should start with small doses and should fractionate these over a long period of time.

Dr. Moore's talk was very intriguing. Just as the radiologists have become familiar with aerography and are beginning to assimilate a background for cerebral arteriography, along he comes with a new and hot technic which we will soon have to learn more about. We have a physicist and a group at our Institute who have been working on similar problems, though we haven't advanced as far as Dr. Moore and his group. Their work is marvelous and is most stimulating. It seems to me that it holds a good deal of promise for the future. The time may come when with one of his detectors and

the use of radioactive materials Dr. Moore will put the probe in the operating wound and he can say, "Well, in this region there is still a little more radioactive material." The surgeon can then remove it and the patient will leave the operating room tumor-free.

T. J. Wachowski, M.D. (Chicago): I came into the room not only because of the excellence of the listed symposium but because of a phrase here in Dr. Peirce's abstract. I refer to: "The question of encephalopathy as an aftermath of radiation therapy, which has been noted by other people." Dr. Peirce is referring to the paper that Dr. Chenault and I gave in 1944, in which we described 6 cases of severe encephalopathy following radiation therapy. These cases were all examined by Dr. Percival Bailey and I am sure Dr. McWhirter would not question his interpretation of the damage.

I had a talk with Dr. Maurice Lenz, who was very curious about the rate of dosage, that is, the number of r per minute. Usually our cases received 50 r per minute. The dose to the tumor varied from a low of 6,000 r in one child who had a medulloblastoma to 9,000 r, or close to that amount, in most of the other cases. It is of some interest that one of the cases, the first one we encountered, had 16 r per minute throughout the course of therapy. The others were treated with the higher flux.

Dr. Lenz thought the number of r per minute had something to do with the discrepancy of our results, that is, the difference between our data and Dr. Peirce's. I believe Dr. Peirce told me after that meeting that his rate was 15 r per minute. Is that right, Dr. Peirce? He nods his head in assent, so that is apparently correct.

Following our experience, we dropped our total dose, so that we are not now exceeding 6,000 r in the tumor. We would like to cut down the r per minute, but the press of work indicated that decreasing the total dose might be the preferable procedure, unless we make the boys work all night. So that has been what we have been doing since 1944. We have no data on longevity, but I do know we have not seen any encephalopathy since then.

Merrill C. Sosman, M.D., *Chairman:* In the few minutes that are left, I am going to call for questions, and I hope the essayists will make note of them as they are asked.

Question: In how many weeks was the 9,000 r mentioned by Dr. Peirce given?

Question: There has been more than one reliable report that 6,000 r would produce, or can produce, irreversible damage to the brain. I find it hard to believe that 9,000 r in such a large series of cases failed to create some kind of irreversible damage such as was described in the cases that have been recorded.

Dr. Sosman: The time factor may be important. I think Dr. Peirce is going to cover that. Any other questions?

Question: I would like to ask Dr. Camp what he considers the normal size or normal limits of size in calcification of the ependymoma.

Question: Do tumors elsewhere than in the brain fluoresce, and if not, why not?

Question: I would like to ask Dr. Camp what is the earliest date at which he would expect physiological calcification in the choroid plexus.

Dr. Sosman: Any other questions? I am going to take the liberty of slipping in a few myself for Dr. Young. What is the importance or relative importance of the best possible technic in the evaluation of your skull films? Where does technic come in? It is something I am sure we all neglect rather than accentuate.

Dr. List, I wish you would bring out the point that the vascular lesions, sometimes of tremendous size, may give no displacement of the ventricles. It was a most disturbing thing when I learned that early in your experimental work.

Dr. Peirce, I would like to have you laugh off this case of mine. We have had, as you know, over 2,000 verified tumors of which about 800 were gliomas and approximately 400 glioblastomas, practically all treated with irradiation. We have totally eradicated the tumor by irradiation in one case and we know we have totally eradicated it because the patient lived seven years and died of what I thought was a massive recurrence of the glioblastoma, but not a tumor cell was to be found at autopsy in serial sections. Death was due to a very profuse brain damage, presumably from irradiation. The patient got what we calculated was in the neighborhood of 6,000 r spread over a period of a year and a half, not even in one series. The time factor there may be important, also.

Dr. Young (*closing*): The opportunity to discuss technic is welcome because this very important aspect of the subject was not considered in the paper. Roentgenograms of good technical quality are indispensable in the diagnosis of disease of the cranium. The head must be positioned properly, avoiding tilt and rotation, and immobilized by a head-holding device and restraining band. Positioning is less difficult when the patient is examined while sitting. Lateral, frontal, and occipital views are minimal requirements and are supplemented by additional views when the clinical findings suggest they are indicated or might be informative. Stereoscopic views are more informative than single projections, and therefore stereoscopic right and left lateral, frontal, and occipital projections are routinely obtained. Facial, basal, and oblique views are included when indicated. A 4-foot target-film distance and a

Potter-Bucky diaphragm are employed to obtain maximal detail and contrast.

Dr. Sosman: I think I might summarize that by saying you can't make good diagnoses without good films, can you?

Doctor Camp, will you close your discussion?

Dr. Camp (*closing*): I agree 100 per cent with what Dr. Young and Dr. Sosman have said about technic. You certainly can't attempt a good diagnosis without good films. I think one has to be practical, however, about the scope of a preliminary roentgenographic examination of the skull. After all, we are limited a little bit by economic factors and cannot make sixteen to twenty skull survey films in each case. If a preliminary examination of four to six roentgenograms does not answer the question in a given case, additional films should be made in special positions as indicated by the symptoms.

In regard to the question about the extent of calcification in a normal pineal, I personally have not made any measurements of the size of the shadow of the pineal calcification. If I were to guess, I would say it would be about $1.2 \times 1.0 \times 0.7$ cm. Personally I have been more interested in pineal displacement, and I think that the amount of the calcification present will have considerable relation to the patient's age. Certainly a small amount of calcification in a child would be highly significant, whereas the same amount of calcification in an adult would have no significance.

In regard to how early one may find physiologic calcification of the choroid plexus, I have observed calcification of the choroid plexus which I considered normal in a child five years of age.

The question of attempting a cytologic diagnosis on the basis of x-ray findings has been raised. I have been particularly interested in the type of calcification occurring in cerebral neoplasms for many years, and it has seemed to me that there must be some basic difference or reason why the calcium deposits are arranged in a certain manner in one type of tumor and in a different manner in another. We have been able to identify a glioma on the basis of the pattern of calcium deposits in 39 per cent of cases. We also noted calcium deposits arranged in a rather typical manner in 29 per cent of ependymomas. This improvement in the roentgenographic recognition of certain types of tumors was possible only because we were willing to venture a diagnosis concerning the type of tumor when certain rather constant roentgenographic changes were present. No method of diagnosis is 100 per cent, but I think if we are just going to say this is a tumor and let it go at that, we won't make very much progress.

Dr. List (*closing*): In regard to Dr. Scott's question, I wish to state that now probably most neurosurgeons do percutaneous angiograms, including myself. I would estimate that about two-thirds to three-quarters of our angiograms are primarily attempted through the closed method, and only if that is unsuccessful or technically unsatisfactory do we try the open method.

I still value thorotrast a good deal. I use it, for instance, in the first place, when there is sensitivity to diodrast. Frankly, I am still a little bit afraid of diodrast, particularly in consecutive use. Recently a new report has come out of transient hemiplegia. I think such strong, concentrated crystalloid solutions are sufficiently irritating to produce serious vascular damage in such a delicate structure as the brain. In those cases, I prefer thorotrast still. I use thorotrast when it is essential that the procedure be carried out under local anesthesia, because there again the thorotrast is not accompanied by any unusual reaction on the part of the brain.

I frankly feel that we should make a determined effort, perhaps by approaching the pharmaceutical industry, to obtain some more satisfactory contrast medium. Probably it should be a colloidal substance which is innocuous to the cerebral circulation and blood vessels and yet has good radiographic properties and the advantage of being excreted in a short time.

Shortly before the war, the Germans had experimentally developed such a substance in ethyl-*tri*iodostearate in colloidal suspension, but unfortunately, I am told, this preparation is unstable and therefore not suitable for general use. It is my hope that eventually such a substance may be found.

Finally, I agree entirely with Dr. Sosman, that it is surprising that vascular malformations produce surprisingly little ventricular deformity in spite of their large size. However, sometimes they are associated with cysts or vast engorgement. They may produce changeable pictures. At one time you see slight indentation of the ventricular system and again definite compression and signs of intracranial pressure that at other times are absent.

Dr. Sosman: Dr. Peirce, you have a lot to answer for.

Dr. Peirce (*closing*): Apropos of the question that has been asked about 9,000 r, you will recall that I said that was our goal. We feel that, if anything is to be accomplished in control of what is left of an astrocytoma after the surgeon has removed as much as he can, this is the probable dosage requirement. If you are going to try to get 9,000 r—and you should not put in more than 200 a day ordinarily and often not as much as that—it means that you are going to figure a factor of a considerable number of weeks. And if you are able to give a tumor dose, we will say, of 9,000 r through four fields, it means that you are eventually going to have 2,250 delivered through each port.

At the present time our tumor dose is between 85

and 90 per cent of the total skin dose, so that the time will run to forty-five or more days. One child of four, who is now living five years after treatment and doing well, was treated over a period of seventy-three days.

Answering the other side of the question, which was brought up by Dr. Wachowski and Dr. Sosman, we thoroughly appreciate that there have been others who have observed what they very honestly believe to be the result of damage through irradiation. Our point is this, that in our series, treated over the last ten years—now eleven—we have as yet seen neither mental deterioration nor, on such material as has been presented so far, any histologic evidence of damage to the brain which can be attributed solely to radiation.

I think perhaps, Dr. Sosman, that the reason for your concern and that of the neurosurgeons in regard to brain damage lies in what we might speak of as a measurable treatment, in which a patient receives in a period of say three weeks a total of 3,000 to 4,000 r, then comes back in three months for another course and in three months more for another. The story, I feel, unquestionably is the same thing we see in radiation therapy elsewhere, repeated lethal or sublethal—I use that word advisedly—doses that do not accomplish the object of so attentuating the tumor or altering its physiology that it no longer carries on its neoplastic activity. If we don't proceed on an all-or-none basis, we are going to create damage to the vascular tissue by repeated insult just as we see it in the other parts of the body when we repeat the treatment with relatively minimal doses. We are all familiar with the patient who returns months or years after "successful" treatment of acne or scleritis, and I think the same thing happens in the brain. That is the reason we feel so very firmly that a full irradiation should be given at once.

Just in summary then, the indications are for dosage in time but not too long a time, and not repeated insult, but consistent treatment up until you think the job is done for the moment. That in our experience runs forty-five to seventy-three days. Gradually increase the dosage up to what you think is the patient's tolerance, and you may have to add just that periodically.

Dr. Sosman: That is a perfectly possible explanation for the damage I reported in our case, because we did give several series of repeated treatments.

Dr. Moore, will you close?

Dr. Moore (*closing*): The question has been asked as to the reason for the localization of fluorescein in brain tumors.

The normal central nervous system has a protective physiological mechanism, a peculiar state of permeability of its capillaries, which inhibits penetration of negatively charged ions into the nervous tissue. The fluorescent dyes, which have a negative charge, ordinarily cannot penetrate into the nervous system under normal conditions, except in infinitely small amounts. Pathological areas of the central nervous system, on the other hand, are readily penetrated by the fluorescein. The action of the fluorescein is not specific for brain tumors but can be demonstrated in inflammatory conditions such as brain abscesses. In addition, there seems to be a specific affinity of fluorescein for brain tumor cells, but this has not been proved. There has been no consistent correlation between the presence of fluorescein in other types of tumors. While some tumors of the gastro-intestinal tract have fluoresced quite vividly, the majority have not.

Several colored dyes have been mentioned as diagnostic agents for brain tumors. For example, Nile blue sulfate has been used at the University of Pennsylvania in animals with experimental tumors of various sorts. More recently, a radioactive derivative of the dye has been used in several patients. The disadvantage of using colored dyes clinically is the resulting deep stain of the patient's skin.

With respect to irritation of the brain by these systems, it should be pointed out that the use of radioactive and fluorescent compounds obviates the necessity of utilizing large concentrations of the diagnostic agent. A previous speaker has mentioned the irritation resulting from the injection of various compounds used for angiography. Broman in Sweden has pointed out that in experimental animals the so-called blood-brain-barrier can be disrupted by injecting diodrast intra-arterially. We have confirmed these studies. I am sure that diodrast would be more toxic in patients with edema already present or with brain tumors.

Regarding other diagnostic technics, I should like to mention the possibility of utilizing ultrasonic technics for the detection of brain tumors. Preliminary steps in this direction have already been taken at the University of Minnesota.

I might add that we have attempted deep x-ray treatment of experimental brain tumors induced in mice. A dosage of 2,000 r (in air) has been given to very small areas over the tumor and it has been possible to liquefy the normal brain and still find viable tumor cells in the treated area.

For therapy, I should think that the roentgenologist should be interested in attempting to find other technics rather than in just trying to find ways of giving larger doses. For example, if one could introduce selectively a heavy metal or a heavy metal-containing compound into brain tumors, the increased secondary radiation resulting from deep x-ray therapy might be of some usefulness. It also has been suggested that if it were possible to introduce Boron^{10} into a tumor selectively, the tumor could be irradiated with a neutron beam and advantage taken of the secondary alpha particles emitted from the boron.

Localization of Intrathoracic Lesions by Means of the Postero-Anterior Roentgenogram

The Silhouette Sign[1]

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WITH THE RAPID advances in thoracic surgery, segmental localization of pulmonary disease has assumed greater importance. This has required that the roentgenologist use any method which may serve to localize disease processes within the thorax. The earliest method of localization was by means of stereoscopic films. Later, combined postero-anterior and lateral roentgenograms were employed. More recent refinements in this direction have included oblique views, laminagraphy, bronchography, etc.

It is often helpful, if possible, to determine the exact location of a pulmonary density from the postero-anterior film alone. The following criteria, currently utilized, are of distinct value in such localization. An area of radiopacity involving the extreme apex of a lung is almost invariably situated in an upper lobe. One which involves a pulmonary costophrenic angle usually lies in a lower lobe. An abnormality in the right upper lung field, the lower border of which is delineated by the minor fissure, lies in the right upper lobe, and in like fashion, a density in the right mid-lung field with a sharp horizontal upper border lies in the right middle lobe.[2] At times a lesion may erode a rib, the sternum, or a portion of the spine, thereby indicating its location. Similarly, displacement of the trachea or barium-filled esophagus may indicate the position of a mass. Rigler (4) has shown that disease processes in the lower lobes or posterior mediastinum, although covered by the heart shadow in the frontal view, may be recognized by the use of slightly overexposed films. However, even with the use of all of these measures, the majority of pulmonary lesions cannot be localized from the postero-anterior view alone.

It is the purpose of this communication to stress a method of localization which has received scant attention in the literature. This method is based on the premise that an intrathoracic radiopacity, if in *anatomic* contact with a border of the heart or aorta, will obscure that border. To our knowledge, the first reference to this phenomenon was made by the late Dr. H. Kennon Dunham (2), who stated, more than fifteen years ago, that obliteration of the left border of the heart by a contiguous pulmonary density indicated disease of the lingula. Subsequently, Robbins and Hale (5), in their classical series of articles on the roentgen appearance of lobar and segmental collapse, made numerous references to obliteration of portions of the silhouette of the heart, aorta, and diaphragm by disease in the lung in contact with these structures. They pointed out that the lung in immediate proximity to the right border of the heart consists almost exclusively of middle lobe, and showed that disease in this location produces loss in definition of the right heart border. They also showed that disease of the lingula obscures the left cardiac border.[3] These findings have been re-emphasized recently by Walker (7), Townsend (6), and Temple and Evans (9). Bachman *et al.* (1), dis-

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[2] Occasionally the fissure which delineates a superior accessory lobe parallels the minor fissure and may be mistaken for it. A density adjacent to this fissure may be incorrectly localized on the postero-anterior roentgenogram (Fig. 1).

[3] Since this paper was submitted, another early reference to the subject, by Hampton and King (8), has been called to our attention.

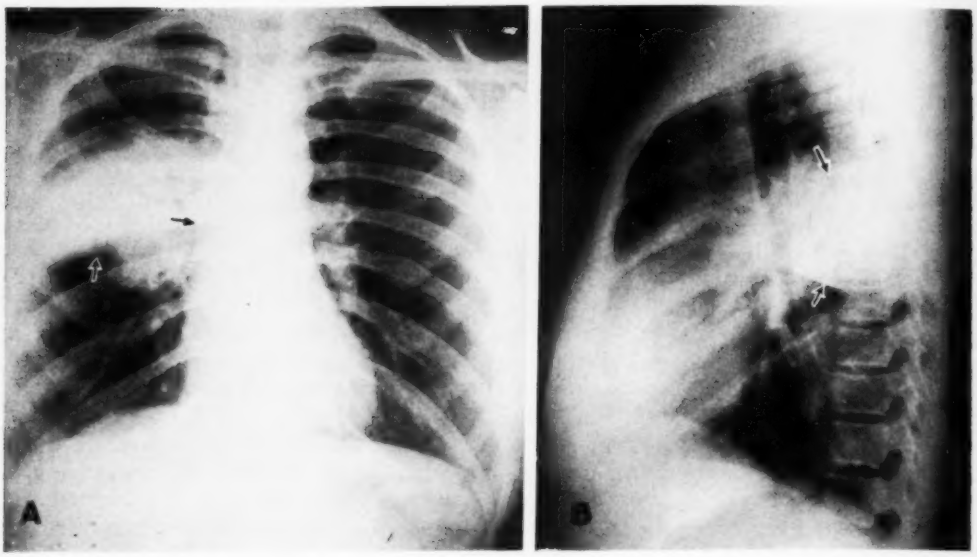

Fig. 1. Lobar pneumonia. A. In the postero-anterior view, the posterior location of the infiltrate is indicated by its failure to obliterate the right border of the ascending aorta (upper arrow). Therefore, the sharp horizontal lower border (lower arrow) suggests involvement of a superior accessory lobe rather than of the upper lobe. B Right lateral view confirms the localization in a superior accessory lobe (arrows).

cussing pleurisy in primary atypical pneumonia, noted that blurring of the usually sharp left lower cardiac border is produced by pleural disease involving the lower end of the left major fissure.

The basic tenet of the present method of localization is adapted from Robbins and Hale and may be restated as follows: *An intrathoracic lesion touching a border of the heart or aorta will obliterate that border on the roentgenogram; an intrathoracic lesion not anatomically contiguous with a border of the heart or aorta will not obliterate that border.* We have adopted the term *silhouette sign* to indicate obliteration of a portion of the cardiovascular silhouette by adjacent disease.

In an effort to reproduce this phenomenon by experimental means, the following procedure, suggested by Dr. Felix Fleischner (3), was carried out: A small quantity of warmed paraffin was poured into an empty x-ray film carton. The carton was then tilted so that the paraffin, on cooling, solidified as a wedge-shaped mass in the corner of the box. The carton was placed back-to-back with a second empty film container of identical size. A roentgenogram was made with the central ray traversing the two boxes. Mineral oil was then poured into the box containing the paraffin wedge and a second film was exposed in a manner similar to the first. Finally, the mineral oil was poured from the first into the second carton and another film exposed.

The first film (Fig. 2A) revealed the triangular shadow of the paraffin wedge sharply outlined by air. This represented the normal heart-lung relationship. The second film (Fig. 2B) showed obliteration of the border of the paraffin shadow along its zone of contact with the mineral oil (silhouette sign), illustrating that the "heart" border was obscured by "consolidation" in the contiguous portion of the "lung." In the third film (Fig. 2C), the border of the paraffin shadow was preserved (absent silhouette sign), demonstrating that the "heart" border was not obliterated by "disease" in non-contiguous areas of the "lung." The above experiment was repeated using a small quantity of mineral oil in the carton containing the paraffin

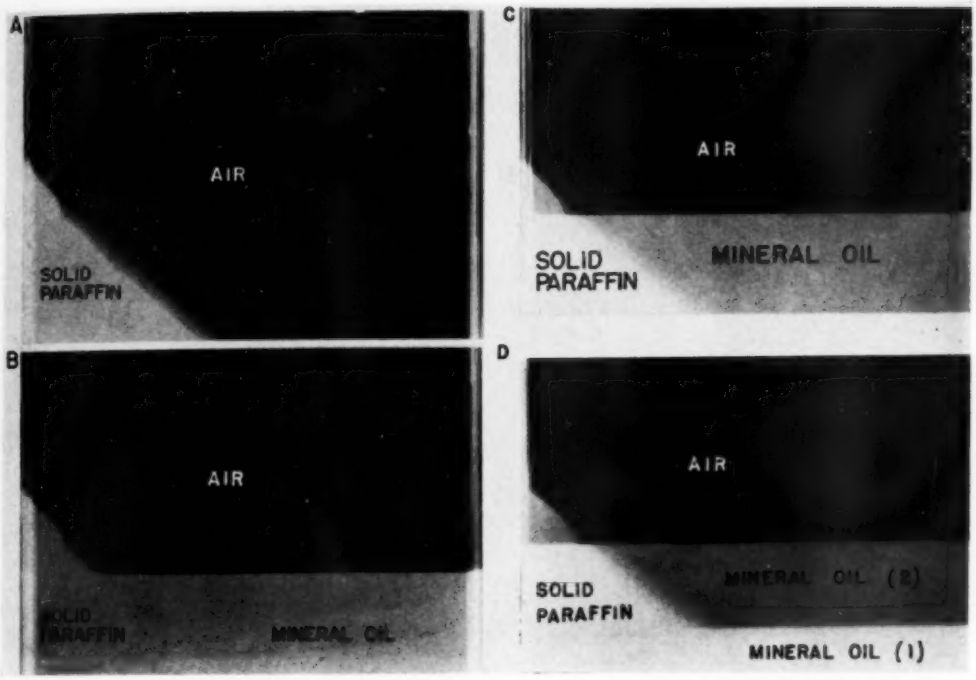

Fig. 2. Experiment illustrating roentgenographically the basic principle of the present method of localization of intrathoracic densities. A. Paraffin wedge in front carton; empty rear carton. B. Paraffin wedge and mineral oil in front carton; empty rear carton. C. Paraffin wedge in front carton; mineral oil in rear carton. Note obliteration of the border of the paraffin shadow in B (silhouette sign) and its preservation in C. D. A small amount of mineral oil was poured into the carton containing the paraffin wedge (1) and a larger amount into the other carton (2). The direction of the central ray was reversed. Note the presence of the silhouette sign below the lower fluid level and the absence of the sign above it. The photographs were not retouched.

wedge and a larger quantity of mineral oil in the second carton, with the relative positions of the roentgen tube and film reversed. These changes did not alter the results (Fig. 2D).

As we are uncertain of the physical principles involved in the production of the silhouette sign, discussion of this aspect of the problem has been omitted.

Since the basic principles were verified by the experimental observations, the following applications appeared to be justified:

1. A shadow which causes obliteration of part or all of a heart border (silhouette sign) is anterior in location and lies in the middle lobe, lingula, anterior mediastinum, lower end of the major interlobar fissure, or anterior portion of the pleural cavity.

2. A density which overlaps a heart border, but does not obliterate it, is posterior in location and lies either in a lower lobe, the posterior mediastinum, or the posterior portion of the pleural cavity.

3. A radiopacity which obliterates the right border of the ascending aorta (silhouette sign) is anteriorly located and is situated either in the anterior segment of the right upper lobe, the middle lobe, the right anterior mediastinum, or the anterior portion of the right pleural cavity.

4. A density which overlies the right border of the ascending aorta, but does not obliterate it, lies posteriorly and is located either in the superior segment of the right lower lobe, posterior segment of the right upper lobe, posterior mediastinum, or posterior portion of the pleural cavity.

5. An opacity which obliterates the left border of the aortic knob (silhouette sign) lies in the apical-posterior segment of

TABLE I: FINDINGS WITH REGARD TO SILHOUETTE SIGN IN 84 PATIENTS

Location of Density	No. of Cases	Heart Border Silhouette Sign		Ascending Aorta Silhouette Sign		Aortic Knob Silhouette Sign	
		Present	Absent	Present	Absent	Present	Absent
R. L. L.	17	0	14	0	5	..	..
L. L. L.	14	0	14	.	.	0	1
R. M. L.	13	13	0	2	0	..	..
L. U. L., lingula	12	12	0	.	.	..	..
L. U. L., apical-posterior segment	8	..	..	.	.	7	1*
L. U. L., anterior segment	4	2	0	.	.	0	2
R. U. L., anterior segment	8	3	0	8	0	..	..
R. U. L., posterior segment	1	0	1	0	1	..	..
Anterior mediastinum	5	5	0	3	0	1†	2
Posterior mediastinum	2	0	2	0	2	..	..
Posterior encapsulation of fluid	4	0	4	0	2	..	..

* See text.

† Tumor involved over half of the anteroposterior diameter of the chest.

the left upper lobe or in the mediastinum adjacent to this segment.

6. A shadow which overlaps but does not obliterate the aortic knob is anterior or markedly posterior in location and lies either in the anterior segment of the left upper lobe, superior segment of the left lower lobe, or in the anterior or posterior portion of the superior mediastinum or pleural cavity.

PRESENTATION OF MATERIAL

The present study was made on 84 patients with various types of intrathoracic disease. These included acute and chronic pneumonia, tuberculosis, atelectasis, encapsulated pleural effusion, tumors of the lung and mediastinum, etc. Roentgenographic evidence of a pulmonary density in contact with or overlapping a cardiovascular border was the only prerequisite in the selection of case material. Localization of the pulmonary shadows was attempted from the postero-anterior roentgenograms, and the accuracy of such localization was then checked by means of the lateral view. When the principles of the present method of localization were not utilized, accurate placement of the lesion was possible, in our hands, in only 20 of the 84 cases (23 per cent); in several instances incorrect localization resulted. In striking contrast, when the present method was applied, we obtained correct results in nearly every instance (Table I).

The right lower lobe was involved in 17 cases. In 14, the disease process overlapped the right heart border, and this border could be clearly visualized in each (Fig. 3). In 5 cases the density overlapped the right border of the ascending aorta, and in each of these the aorta remained sharply outlined.

The left lower lobe was involved in 14 cases, the infiltrate overlying the heart border in each. The left border of the heart was clearly delineated in every instance (Fig. 4). In one case the shadow also partly covered the aortic knob without affecting its outline.

The right middle lobe was involved in 13 cases, and in each the right heart border was obliterated (Fig. 5). In 2 cases the disease in the middle lobe was also contiguous with the ascending aorta and obliterated its right border.

In 12 instances the lingula was involved (alone in 5 and in combination with other portions of the left upper lobe in 7). In all of these cases, the left heart border was obliterated at the area of contact (Fig. 6).

Thus, densities in the middle lobe and lingula produce the silhouette sign, while those involving the lower lobes do not.

Among 12 cases involving segments of the left upper lobe exclusive of, or in addition to the lingula, there were only 2 in which the disease process was in apposition with the heart, and in each the left upper heart border was obliterated. In one of these the disease was confined to the anterior segment (Fig. 5) and in the other all

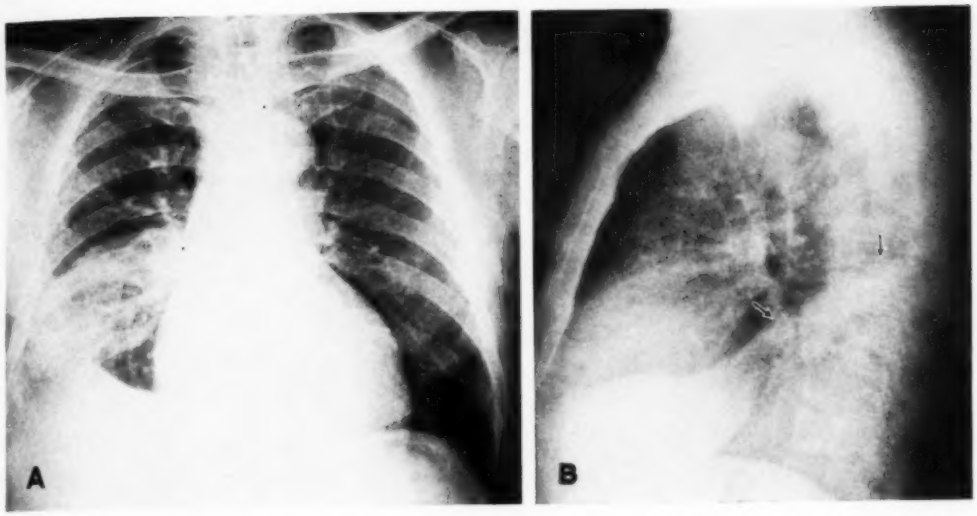

Fig. 3. Lobar pneumonia with partial collapse. A. In the postero-anterior view the right border of the heart and ascending aorta is preserved, indicating that the density lies posteriorly. B. Right lateral view confirms the lower lobe localization (arrows).

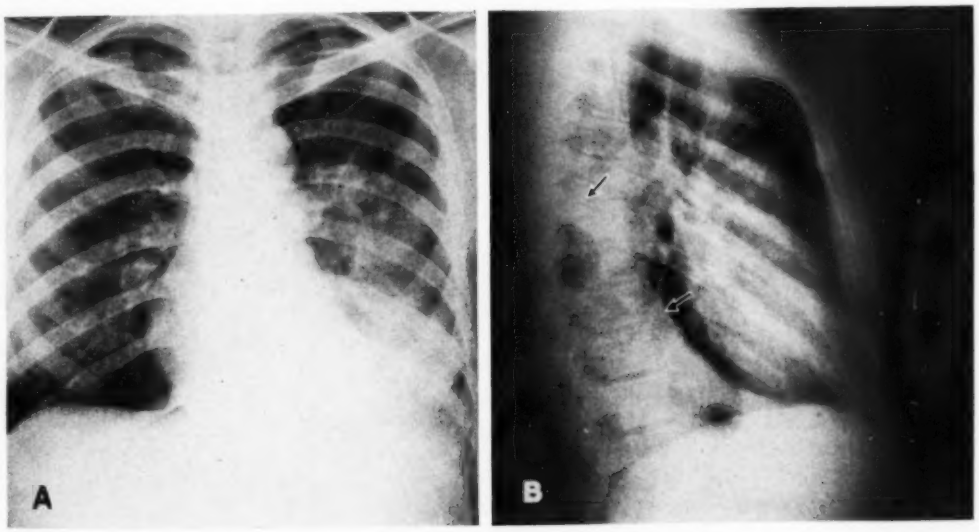

Fig. 4. Tuberculosis with cavitation, bronchostenosis, and collapse. A. In the postero-anterior view the preservation of the left heart border indicates lower lobe disease. B. Left lateral view confirms the localization (arrows).

segments except the lingula were involved. In 10 cases the diseased area made contact with or overlapped the left border of the aortic knob. In 7 of these the aortic knob was obliterated (Fig. 7). In all 7 the apical-posterior segment was affected, although in only one instance was the disease entirely confined to this segment. In 3 cases the aortic knob remained visible. The anterior segment alone was involved in 2 of these (Fig. 5). In the third case the entire left upper lobe was solidly involved (Fig. 8). This case proved to be the only exception to the observation that oblitera-

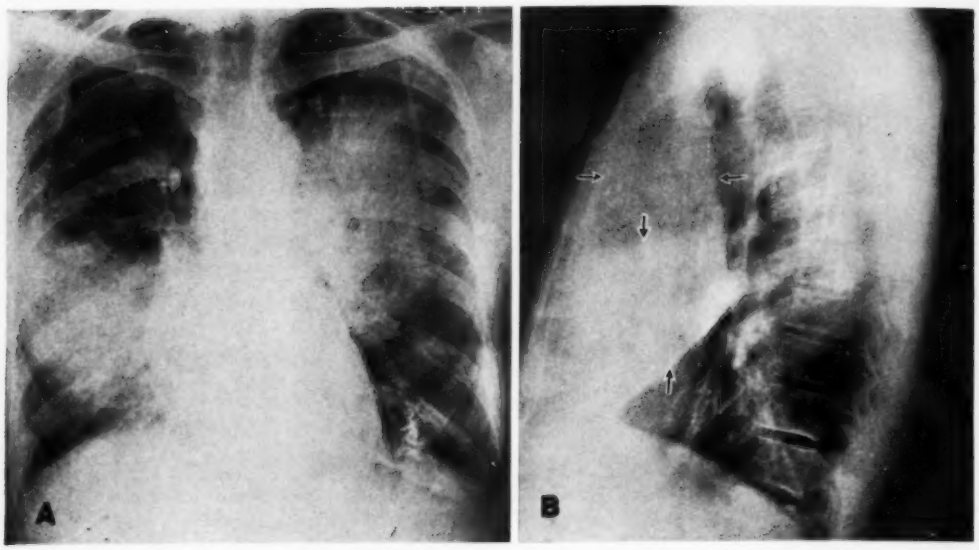

Fig. 5. Lobar pneumonia. A. The obliteration of the right heart border indicates middle lobe involvement. The obliteration of the left upper heart border, with preservation of the shadow of the aortic knob, localizes the left density to the anterior segment of the left upper lobe. B. The right lateral view verifies the findings. The vertical arrows define the infiltrate on the right, and the horizontal arrows delineate that on the left.
Note obliteration of the medial portion of the right diaphragmatic shadow in the postero-anterior view.

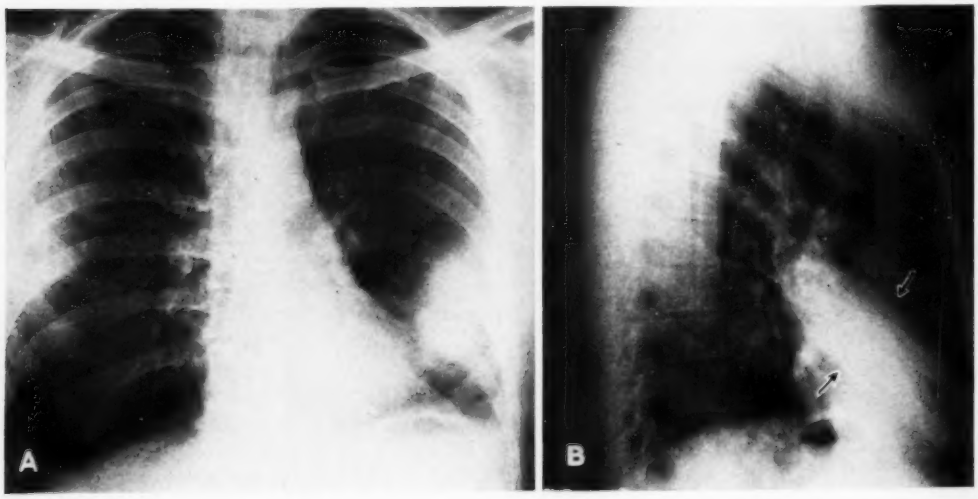

Fig. 6. Lobar pneumonia. A. Obliteration of a segment of the border of the heart in the postero-anterior view signifies that the infiltrate lies anteriorly. B. Left lateral view verifies the presence of lingular disease (arrows).

tion of the knob indicates disease of the apical-posterior segment.

Therefore, in the case of left upper lobe disease, if the heart border shows the silhouette sign, anterior segment involvement may be postulated; if the aortic knob presents this sign, the apical-posterior segment is usually the site of the lesion. The explanation for these findings becomes apparent when it is recalled that the heart lies

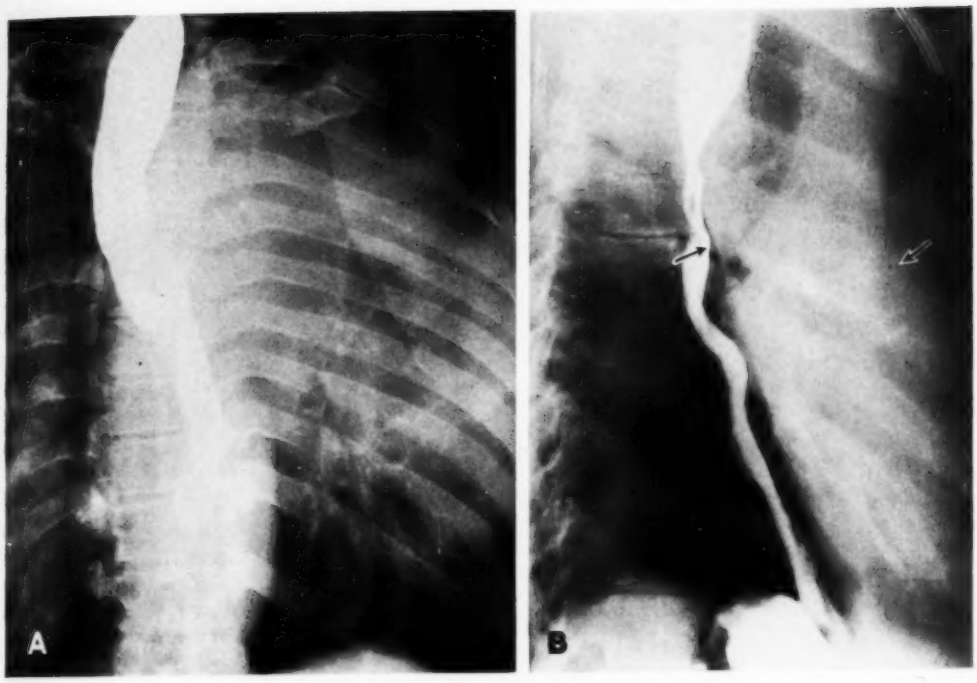

Fig. 7. Extensive carcinoma. A. Bucky anteroposterior view showing obliteration of the left heart border, which indicates lingular involvement, and obliteration of the aortic knob outline, which denotes disease in the apical-posterior segment. B. Left lateral Bucky film shows involvement of the entire left upper lobe.

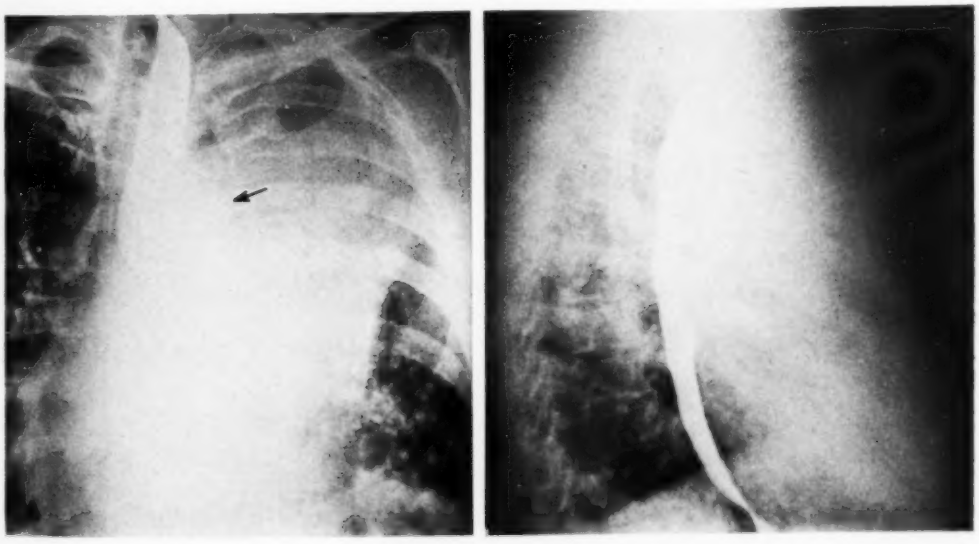

Fig. 8. Bronchogenic carcinoma. A. The postero-anterior view shows obliteration of the left heart border by density in the lingula, but preservation of the outline of the aortic knob (arrow) which signifies that the apical-posterior segment should *not* be involved. B. Lateral view shows involvement of the entire left upper lobe. This is the only instance of incorrect localization in the present study.

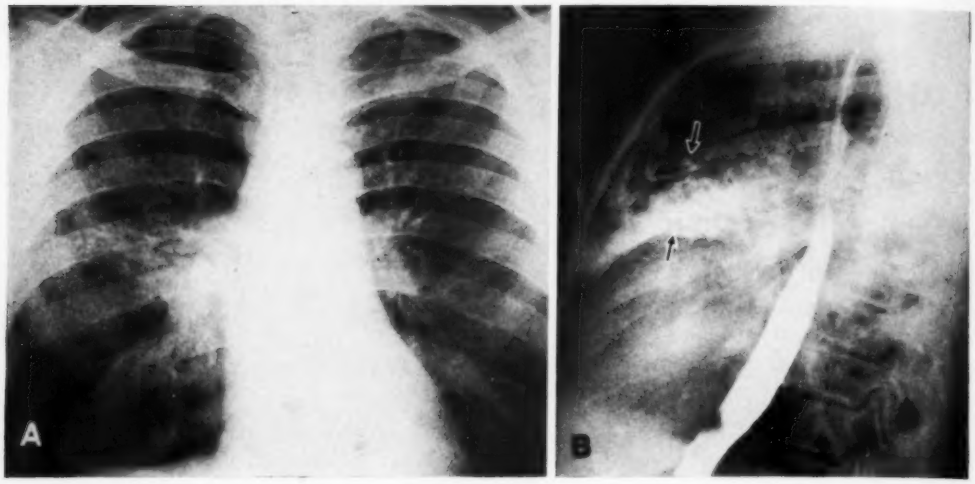

Fig. 9. Bronchiectasis. A. Obliteration of the right border of the ascending aorta in the postero-anterior view denotes anterior location of the radiopacity. B. In the right lateral view the infiltrate (arrows) proves to lie in the anterior segment of the right upper lobe.

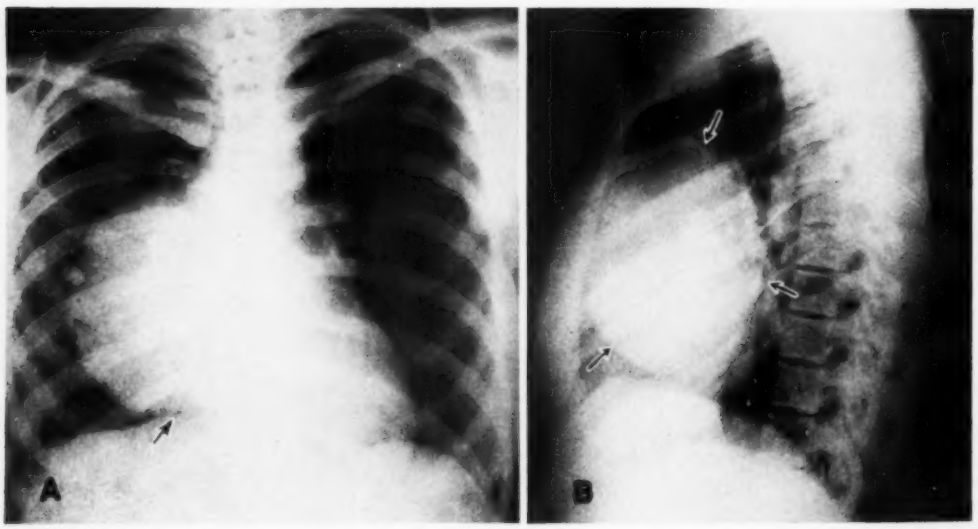

Fig. 10. Lymphoma of mediastinum. A. In the postero-anterior view the right border of the heart (arrow) and ascending aorta are obliterated by the mass, indicating that it lies anteriorly. B. Right lateral view confirms the localization.

anteriorly in the thorax, while the aortic knob lies more posteriorly.

The right upper lobe was involved in 9 cases. In 4 the density was contiguous with the right upper border of the heart, obliterating it in 3. In each of the 3 the anterior segment was affected. In the fourth case the heart border was preserved because the density was confined to the posterior segment. In all 9 cases the radiopacity made contact with or overlapped the ascending aorta. This structure was obliterated in 8 (Fig. 9), in each of which the anterior segment was involved (alone in 3 cases and in combination with other segments in 5). In the one case in

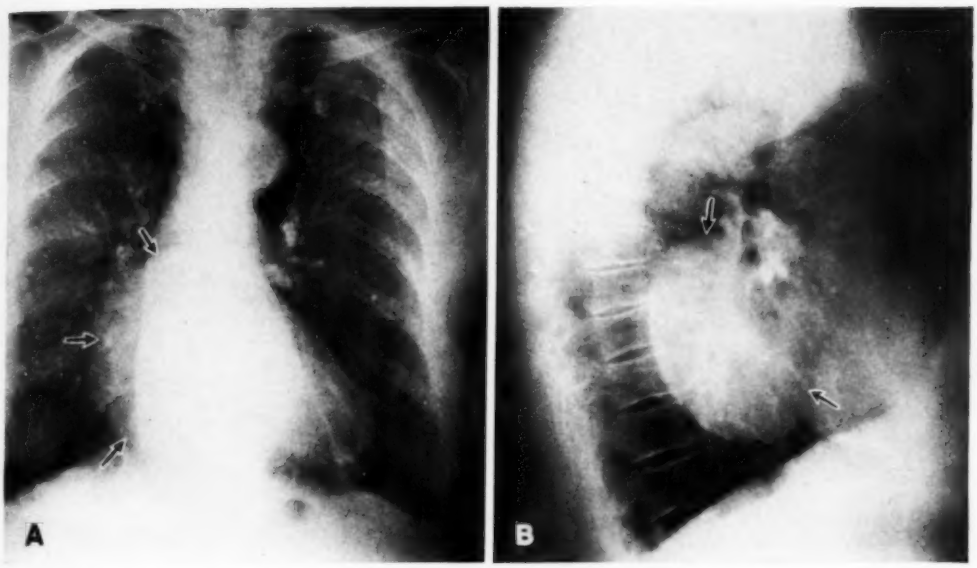

Fig. 11. Bronchogenic cyst of mediastinum. A. The postero-anterior view shows preservation of the right border of the heart and aorta, indicating the posterior position of the mass (arrows). B. The right lateral view confirms this (arrows).

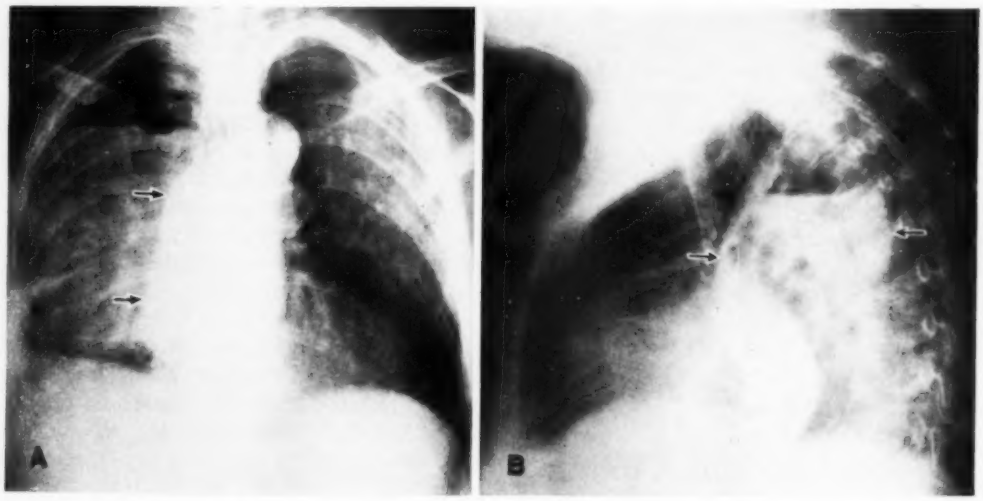

Fig. 12. Encapsulated right pyopneumothorax. A. The postero-anterior view shows preservation of the right border of the heart and ascending aorta (arrows). B. Left anterior oblique view verifies the posterior location of the encapsulation (arrows).

which the border of the ascending aorta was not affected, the disease was confined to the posterior segment.

From this it is apparent that densities in the anterior segment of the right upper lobe produce the silhouette sign while those in the posterior segment do not.

Obliteration of a heart border occurred in each of 5 cases of tumor of the anterior mediastinum (Fig. 10). The ascending

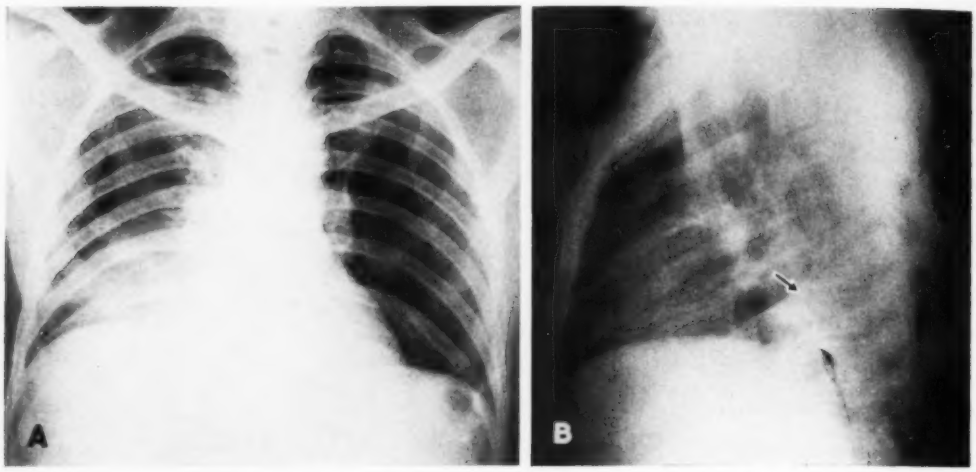

Fig. 13. Postoperative collapse. A. Preservation of outline of the right border of the heart and of the right diaphragm (apparent on the original film, lost in reproduction). B. The right lateral view shows collapse of the right lower lobe. This case shows that densities in the lower lobe may fail to obliterate the diaphragm contour in the postero-anterior view.

aorta was obliterated in the 3 cases in which it was in contact with the tumor, and the aortic knob was preserved in the 2 cases where overlapping occurred. In 2 cases of posterior mediastinal tumor the border of the heart and ascending aorta appeared normal, although overlapping of these structures occurred (Fig. 11).

Four cases with posterior encapsulation of fluid were encountered, and the heart border was preserved in each. In the 2 cases in which the effusion was superimposed upon the ascending aorta, the right border of this structure remained intact (Fig. 12).

Thus, in the case of a mediastinal or pleural mass, the presence or absence of the silhouette sign indicates the general anteroposterior location.

DISCUSSION

The present study confirms the observation made by Robbins and Hale that collapse of a lobe or segment of the lung contiguous with a border of the heart obliterates that border. We have extended this concept to include not only the effect upon the heart outline, but also upon that of the ascending aorta and aortic knob. We have found that these structures are likewise obliterated on the postero-anterior roentgenogram by pulmonary densities which lie in actual contact with them. We have also noted that the same effect (the silhouette sign) is produced by any radiopaque intrathoracic shadow, whether it be of pulmonary, pleural, or mediastinal origin. It is possible that similar principles may be applicable to other regions of the body, such as the abdomen.

The effect of pulmonary densities on the outline of the diaphragm was also investigated. Robbins and Hale stated that collapse of a lower lobe often resulted in obliteration of a large segment of the diaphragm, whereas collapse of the middle lobe had no such effect. Our study included 25 instances of lower lobe disease in which the density extended to the dome of the diaphragm. In 20 of these (80 per cent) obliteration of the diaphragmatic contour occurred (Figs. 3 and 4). In 5 cases the contour of the diaphragm remained sharp in the postero-anterior view (Fig. 13). There were also 14 cases in which the diaphragmatic surface of the middle lobe or lingula was similarly affected. In 6 (42 per cent) the border of the diaphragm was obliterated in the frontal view (Fig. 5), and in the remaining 8 it was

clearly defined. These findings, which are at variance with those of Robbins and Hale, indicate that persistence or loss of the outline of the diaphragm is of little value in the accurate localization of pulmonary densities from the postero-anterior film.

In utilizing the present method mistakes in localization can be avoided if the following points are borne in mind:

1. The technical quality of the roentgenogram must be such that the diseased area is adequately penetrated. An underpenetrated film may appear to show, falsely, obliteration of a cardiovascular border.

2. The outline of the cardiovascular structure must be clearly visible beyond the shadow of the spine. Many cases are encountered in which the right border of the heart and aorta do not project into the right thorax. In such instances the silhouette sign cannot be applied.

3. The abnormal density must either overlap or be contiguous with a portion of the cardiovascular border. Obviously, peripheral lung lesions cannot be localized by this method.

4. The diseased area contiguous with the cardiovascular margin must be completely airless. The method cannot be applied to air-filled cavities.

5. Partial or incomplete obscuration of a cardiovascular border has the same significance as complete obliteration, *i.e.*, it indicates the presence of the silhouette sign.

6. When two diseased areas are superimposed in the postero-anterior roentgenogram, only that portion which obliterates a cardiovascular border can be localized. For example, if the right middle and right lower lobes are both involved, the right cardiac border will be obliterated by the middle lobe disease. In such a case, the presence or absence of right lower lobe involvement cannot be determined from the postero-anterior film by this method.

Since this study was begun, the method described has been applied to many more than the 84 cases included in this report. The high degree of accuracy has been maintained, and the method has afforded an excellent means of localizing intrathoracic lesions from the postero-anterior roentgenogram.

SUMMARY

A method of localizing intrathoracic lesions from the postero-anterior roentgenogram of the chest is presented. It is based upon the following hypothesis: An intrathoracic lesion anatomically contiguous with a border of the heart or aorta will obliterate that border; such a lesion not contiguous with a border of the heart or aorta will not obliterate the border.

The term *silhouette sign* has been used to indicate obliteration of a part of the cardiovascular silhouette by a disease process.

This method has been tested in 84 cases, and accurate localization was obtained in nearly every instance.

NOTE: We wish to express our gratitude to Drs. Marian A. Blankenhorn, Emanuel J. Levin, Carl P. Wisoff, and Edward A. Gall for their assistance in this study.

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(*Para el sumario en español, véase la página siguiente.*)

SUMARIO

Localización de las Lesiones Intratorácicas por Medio de la Radiografía Postero-Anterior. El Signo de la "Silueta"

Preséntase un método para localizar las lesiones intratorácicas por la radiografía postero-anterior del tórax. Básase el mismo en la hipótesis de que una lesión anatómicamente contigua con uno de los bordes del corazón o aorta, obliterará dicho borde, lo cual no sucederá sino es contigua.

Los AA. denominan "signo de la silueta" a ese desvanecimiento de toda la silueta cardiovascular o de parte de la misma.

El método fué ensayado en 84 casos de afección intratorácica, obteniendo localización exacta en casi todos los casos, según demostraron las vistas laterales, es decir, que las condensaciones en el lóbulo medio y la língula produjeron el signo de la silueta, en tanto que no era así con las que afectaban los lóbulos inferiores.

Tratándose de afección del lóbulo superior izquierdo, si el borde cardíaco muestra el signo de la silueta, cabe anticipar invasión del segmento anterior; si el nudo aórtico presenta dicho signo, el segmento apicoposterior suele ser el asiento de la lesión.

Las condensaciones en el segmento anterior del lóbulo superior derecho evocaron el signo, pero no las del segmento posterior.

La localización anteroposterior general de las tumefacciones mediastínicas y pleurales quedó también indicada por la presencia o ausencia del signo de la silueta.

Señálase que este método sólo tiene aplicación a las sombras anómalas sobrepuestas a, o contiguas con, una porción del borde cardiovascular, siendo manifiesto que no cabe localizar en esta forma las lesiones periféricas del pulmón.

Effects of Internal Irradiation of Mice with P^{32}

Part I: Spleen, Lymph Nodes, Thymus, Bone and Bone Marrow[1]

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THE ACCUMULATION of accurate data on radiation injury resulting from internal radioactive materials is of utmost importance. Such information will aid in outlining radioactive isotope therapy for cancer and other conditions and in formulating a therapeutic program in the event of human injury from internal radiation. It is the purpose of this study to determine the radiation effects in mice injected with P^{32}.

The mouse was selected as a subject because of its extreme radiosensitivity, which is somewhat comparable to the degree of radiosensitivity in man. In studying the effects of continuous radiation from a substance spread throughout the body tissues, it is necessary for evaluation of the changes produced in them, and determination of their radiosensitivity, not only to describe morphologic changes ascribed to radiation effect but also to know the general pattern of radiation intensity. The pattern of radiation intensity in the tissues depends upon two factors: first, the physical characteristics of the radiation; second, the chemical properties of the radioactive material. The degree of retention and the rate of excretion, as well as the localization and concentration of the radioactive material within special tissues, depend on its chemical properties.

The radiations from P^{32} are moderately soft beta rays with an average mev of 0.7; they are completely absorbed by 8 mm. of tissue, and 50 per cent absorbed by 3 mm. of tissue. Determinations of diffusion, partitioning, and excretion of P^{32} have been made on rats, rabbits, and mice (5). The distribution in the tissues of normal and leukemic patients has also been determined (3, 4). These studies indicate that for several days after injection the visceral organs, especially the liver and spleen, have the greatest concentration of the isotope. After the first few days, however, the P^{32} content of these organs decreases and the greatest concentration is in the bone. About two weeks after injection, little or none is to be found in the visceral organs, but the bones retain significant amounts for more than five weeks. The P^{32} is laid down most rapidly in growing bone.

Since the mice used in our work were adult, there would be little bone growth, and this would result in an almost equal distribution of P^{32} throughout the skeleton. Bone and bone marrow would receive the greatest amount of radiation, with moderate amounts reaching tissues adjacent to and within 2 to 4 mm. of sizeable bones, and the smallest amounts reaching tissues well removed from the bones.

The first part of this study is concerned with the spleen, lymph nodes, thymus, bone, and bone marrow.

MATERIALS AND METHODS

Eighty-two adult Swiss strain mice averaging 31 gm. were divided into four groups. Each of three groups was subcutaneously injected with a different dose of carrier-free P^{32} in 2 c.c. of isotonic saline: a dose uniformly lethal in six days, 2,000 μc. (2 mc.); a dose lethal to 50 per cent of the mice in 18 days, 250 μc.; a dose which produced minimal clinical changes, 25 μc. Twelve mice were given 2,000 μc., 40 mice were given 250 μc., 20 mice were given 25 μc., and 10 mice were used as controls.

[1] From the Laboratory of Pathology of the Harvard Cancer Commission, Harvard Medical School. This work was done under contract from the Office of Naval Research and Atomic Energy Commission. Accepted for publication in November 1949.

The P^{32} used was supplied by Oak Ridge National Laboratories, Oak Ridge, Tenn.

TABLE I: SUMMARY OF GROUPS OF MICE INJECTED WITH P^{32}

Group 1: Injected with 2.0 mc. P^{32} in 2 c.c. isotonic NaCl solution	12 mice	Lethal dose	2 mice died 4 days post-injection 3 mice died 5 days post-injection 1 mouse died 6 days post-injection 6 mice sacrificed 6 days post-injection
Group 2: Injected with 250 μc. P^{32} in 2 c.c. isotonic NaCl solution	40 mice	I. 12 mice for study of early changes (10 days)	1 mouse died 8 days post-injection 1 mouse died 9 days post-injection 10 mice sacrificed 10 days post-injection
		II. 12 mice for study of late changes (10 to 20 days)	2 mice died on 11th day post-injection 2 mice died on 13th day post-injection 1 mouse died on 17th day post-injection 1 mouse died on 18th day post-injection 6 mice sacrificed on 18th day post-injection
		III. 16 mice for study of progressive changes, at about 2-day intervals	2 mice sacrificed at 2 days post-injection 2 mice sacrificed at 4 days post-injection 2 mice sacrificed at 7 days post-injection 2 mice sacrificed at 9 days post-injection 1 mouse died at 12 days post-injection 1 mouse died at 13 days post-injection 2 mice died at 16 days post-injection 2 mice sacrificed at 50 days
Group 3: Injected with 25 μc. P^{32} in 2 c.c. isotonic NaCl solution	20 mice	I. 10 mice for study of early changes	10 mice sacrificed 10 days post-injection
		II. 10 mice for study of late changes	10 mice sacrificed 80–90 days post-injection
Group 4: Control animals	5 females 5 males		

The animals were caged so as to be protected from the radiation of excreted P^{32}.

The groups of mice receiving these three graded doses of P^{32} were further subdivided to determine early (under ten days) effects and later (ten to twenty days and over) effects. In addition, a third of the animals receiving 250 μc. were killed at two-day intervals during the first sixteen days for a study of progressive morphologic changes. See Table I.

CLINICAL COURSE

The group of 12 mice receiving the lethal dose of 2 mc. of P^{32} showed evidence of radiation injury within twenty-four hours after injection, manifested by reduced motor activity, diarrhea, and refusal of food and water. Three days after injection the mice moved only occasionally; they were obviously dehydrated, had ragged coats, and refused food and water constantly. These changes progressed until the mice died or were moribund within six days after injection. At this time they had lost approximately 10 gm. of weight, which represented a third of their initial weight.

The 40 mice given 250 μc. showed symptoms similar to but of later onset and less extreme than those in the previous group. Five or six days after injection, these mice were appreciably less active than the controls, their coats appeared sparse, and a few of them had a definite diarrhea. Diarrhea was seen in almost all by the tenth day after injection, but was not so marked as in the mice receiving 2 mc. Loss of weight became apparent about ten days after injection. Those mice that survived eighteen days had lost 9 gm. or about 29 per cent of their original weight.

The mice receiving the smallest dose, 25 μc., showed no change in behavior, appearance (except for slight epilation in a few cases), or weight, as compared with con-

trols, during the eighty-day observation period.

GROSS AUTOPSY OBSERVATIONS

The principal gross autopsy observations were emaciation, dehydration, definite abnormalities in the size of the lymphoid organs, and hypoplasia of the bone marrow. These findings depended upon amount of P^{32} injected and length of time after injection. There were no grossly demonstrable hemorrhagic tendencies and no infectious processes in any of the animals.

In the 2-mc. group (animals dead or dying within six days) all the mice showed pronounced emaciation, as evidenced by loss of nearly all the body fat, and marked dehydration, with dry, sticky serosal surfaces and dry subcutaneous tissues. The thymuses were almost completely destroyed; the spleens were about one-eighth normal size; the bone marrow was definitely pale and dry.

The 250-μc. animals all showed a moderately severe progressive dehydration and emaciation for the first ten days after injection. In some of the animals autopsied at ten to eighteen days dehydration and emaciation had progressed to as severe a degree as in the 2-mc. mice. In others, however, improvement was observed by the eighteenth day. The two mice autopsied at fifty days were normal in weight, nutrition, and hydration. The lymphoid tissues showed regression for the first ten days, but by fifteen days regeneration was evident grossly and some of the eighteen-day animals and the two fifty-day animals showed lymphoid organs larger than normal. The bone marrow was hypoplastic for ten to fifteen days and then regained its normal moist red appearance.

At ten days after administration of 25 μc. there was shrinkage of the lymphoid tissues which did not persist twenty days after injection. At eighty-four days the lymphoid tissues were markedly enlarged, the spleens being from one and a quarter to four times normal size. In the eighty-four-day group, one mouse had developed a neoplastic enlargement of all lymphoid tissues, with the spleen eight times normal size and the thymus filling one half the thoracic cavity.

MICROSCOPIC AUTOPSY OBSERVATIONS

The following organs were selected for histologic study: (1) spleen, (2) mediastinal lymph nodes, (3) thymus, (4) bone and bone marrow from the femur and vertebrae, (5) ovaries, (6) testes, (7) kidneys, (8) adrenals, (9) digestive tract levels from stomach or esophagus, and small and large bowel, (10) spinal cord, (11) lungs, and (12) liver. The first four organs are described in this paper; the remainder in Part II. Hematoxylin and eosin stains were used on multiple sections of all organs. The bone marrow sections were stained according to the Wright-Giemsa technic. Special stains for fat and reticulum and pigments were also employed as indicated. Ten normal control animals were similarly autopsied and sectioned.

SPLEEN

In the mouse spleen normally there are two characteristic features: fusion of red and central white pulp with indistinct separation, and usually a moderate amount of myelopoiesis in the red pulp, manifested by clumps of six to eight pronormoblasts or normoblasts and also a number of young granulocytic cells. In addition, scattered throughout the red pulp are many megakaryocytes, which are typically large multinucleated cells (Fig. 2). The sinusoids are packed with red blood cells. The fixed macrophages contain a few fragmented red cells and pigment.

Within the central white pulp of the mouse spleen there are, per cross section, 7 to 15 well defined malpighian bodies or follicles lying in close relation to the central arteries. The central lymphocytes of the follicles are characteristically large and pale and show numerous mitotic figures (Fig. 1). In addition, there are reticular fibers, with closely applied reticu-

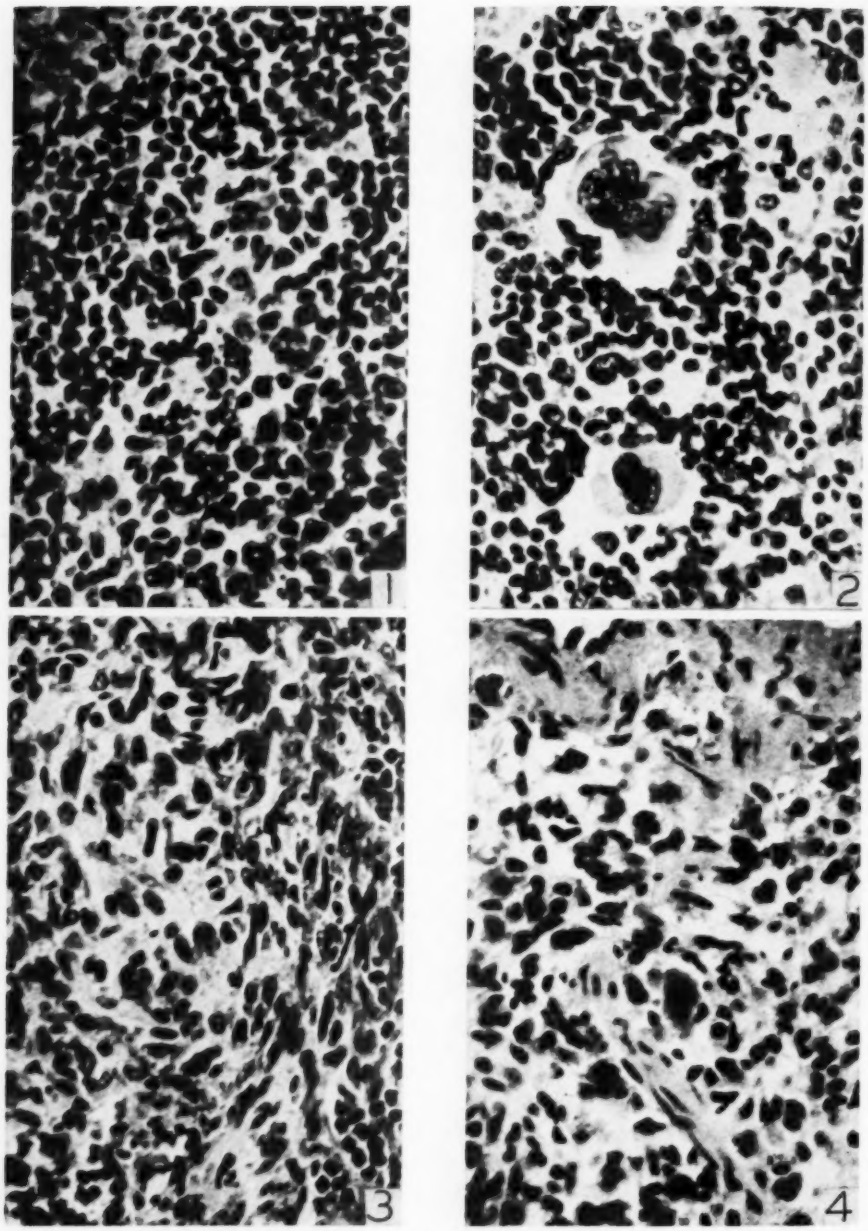
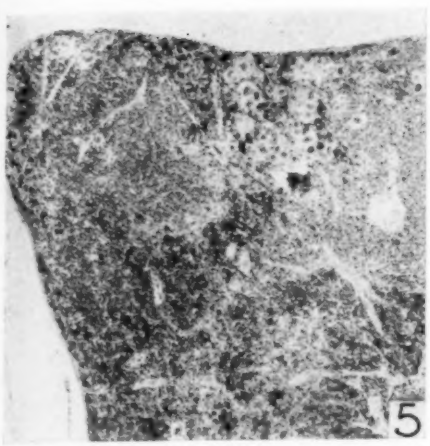


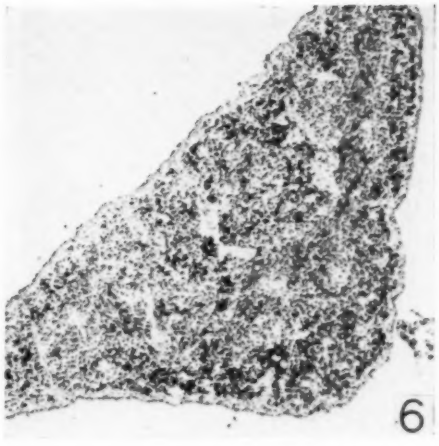
Fig. 1. Normal spleen with closely packed lymphocytes of white pulp bordering red pulp seen at border of photograph. × *c.*500

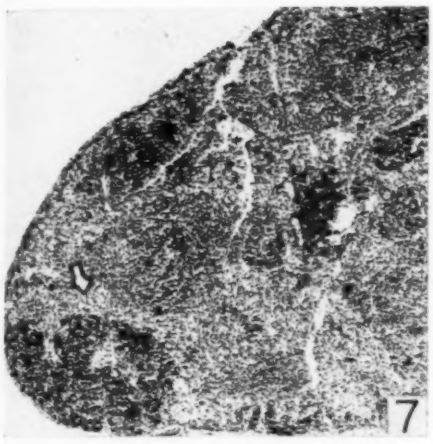
Fig. 2. Megakaryocytes seen normally in splenic red pulp. × *c.*500.

Fig. 3. A lymphoid follicle five days following injection of 2 cm. of P^{32}. Note absence of lymphocytes, presence of plasma cells, early fibrosis and free macrophages, with cellular debris. × *c.*500.

Fig. 4. Five days after injection of 2 mc., showing thickened capsule, empty sinusoids of red pulp and remains of a megakaryocyte (center). ×*c.*500.







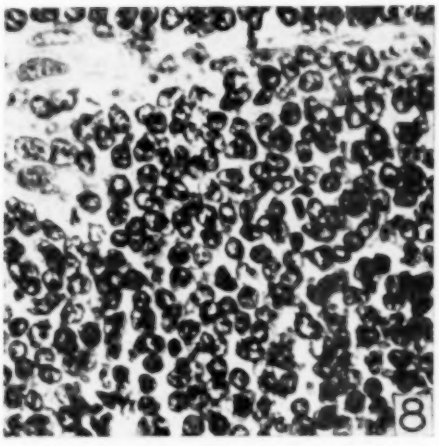
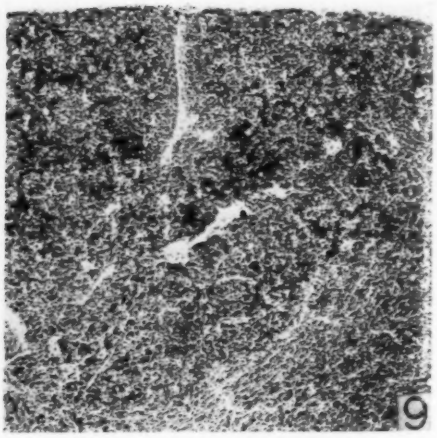


Fig. 5. Section of normal spleen. Note germinal centers and normal pulp relations. ×50.
Fig. 6. Section of spleen five days after injection of 2 mc. of P^{32}. Contrasted with normal size, note shrinkage and distortion. ×50.
Fig. 7. Return of lymphopoiesis; two foci beneath capsule and one centrally (darker staining areas) in spleen ten days after injection of 250 μc. of P^{32}. ×50.
Fig. 8. Enlarged margin of lymphopoietic center showing closely packed lymphoblasts in spleen, (taken from same animal as Fig. 7, at arrow) ten days after injection of 250 μc of P^{32}. ×500.

lar cells and fixed macrophages, extending into the red pulp. About these structures there are normally collections of maturing lymphoblasts.

The spleens of the 2-mc. mice after five days showed scarcely any surviving lymphocytes. The pulp of the entire organ was shrunken, and the capsule thickened (Fig. 4). The characteristic nodular pattern of the white pulp was entirely changed. The center of the spleen was composed of a core of elongated fibroblasts mixed with solid clumps of plasma cells (Figs. 3 and 4). The red pulp contained large amounts of pigment and fragmented pyknotic cell remnants. Spotty hemorrhages and large empty sinuses were present.

The mice given 250 μc. showed immediate (four days) depression of lymphopoiesis. The previous germinal centers were occupied by clumps of plasma cells and occasional shrunken reticular cells, and were surrounded by fibroblasts. Five days after injection the megakaryocytes also



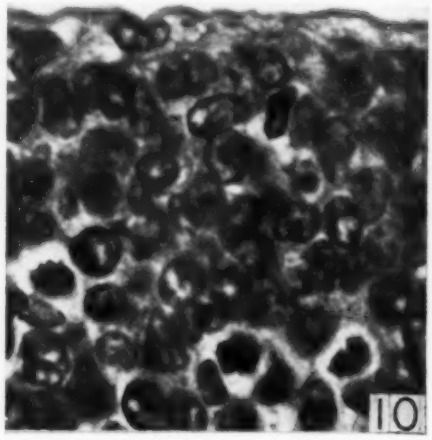


Fig. 9. Lymphoma of spleen developing eighty-four days after injection of 25 μc. of P^{32}. Note loss of white and red pulp outlines. ×50.

Fig. 10. Enlarged section of lymphomatous spleen showing closely packed lymphoblasts and three mitotic figures. ×1,000.

had degenerated, usually forming large masses beneath the capsule. At twelve days all cells of the red pulp were pyknotic and distorted by what appeared to be collections of fibroblasts, myeloblasts, and free macrophages. There were, however, definite small foci of prominent reticulum cells and normal lymphoblasts originating in the white pulp. These foci were entirely new developments, bearing no apparent relation to the original lymphopoietic foci (Fig. 7). Almost all of these areas showed a moderate number of mitoses of medium-sized lymphocytes at the ten to twelve day post-injection stage (Figs. 8 and 13). Return of myelopoiesis was not well established until about sixteen days; it was maximally established in about eighteen days. By twenty days the proliferating myeloid cells packed the red pulp and sinusoids and crowded into the white pulp. This myeloid activity and the well developed lymphoid reaction centers, plus the active mitotic division of the primitive reticular cells in the sinuses, obscured the structural pattern and resulted in slight splenic enlargement (Table II) (Figs. 12 and 14). By the fiftieth post-injection day isolated clumps of plasma cells and small shrunken inactive lymphocytes with surrounding fibrosis remained as evidence of radiation injury. In general, lymphopoiesis was actively reestablished in well defined follicles, and the spleens were of normal size. Megakaryocytes were small, with only two to three lobules to a nucleus, but were dispersed in normal pattern and numbers. Myelopoiesis was marked throughout the red pulp, with cells of the granulocytic series most numerous.

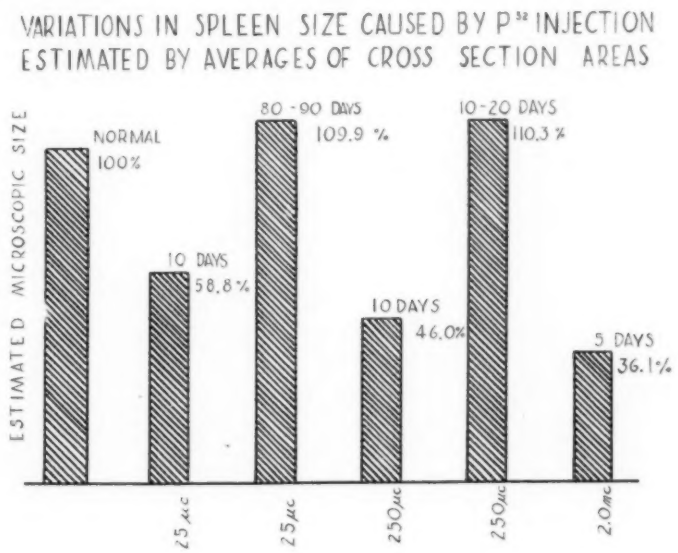
The spleens of mice given 25 μc. were reduced to about two-thirds to one-half of normal size within ten days (Table II). The principal reduction in cells was in the lymphoid series. The follicles were diminished in number and size, but there appeared to be an increase in the proportion of immature and blast cells. Even with this minimal dose, the megakaryocytes were shrunken, showed vacuolization of the cytoplasm and karyorrhexis of the large nuclei, and were slightly reduced in numbers. The red pulp showed no essential change except for congestion with red blood cells and partially fragmented polymorphonuclear cells and other nuclear debris. The normally occurring foci of erythropoiesis beneath the capsule were present and active but extremely small, consisting of about 16 to 20 cells. By eighty-four days the spleens were slightly

enlarged. Lymphopoiesis within the follicles was normal. The reticulum cells in both the red and white pulp were actively dividing and giving rise to numerous lymphoblasts outside of the follicles. An increase in the small type of megakaryocytes was noted in the red pulp. Myelocytes, young granulocytes, dense clumps of erythroblasts, and normoblasts in the red pulp gave evidence of very active myelopoiesis. The spleen involved by lymphoma was encountered in this group (Figs. 9 and 10).

of the hilar and cortical regions. Sinuses are normally wider than in human nodes and are lined by plump endothelium, almost cuboidal in cross section. Normally several well defined active germinal centers are found in each section of node (Fig. 16). Because, as indicated above, it is important for purposes of investigation to observe nodes from the same location, we have confined our study to the mediastinal lymph nodes.

The lymph nodes of the animals given the lethal dose of 2 mc. showed, first, an

TABLE II



LYMPH NODES AND THYMUS

Because of the close morphologic relationship of lymph nodes and thymus, they are best considered together. The thymus of the mouse has a fixed proportion of dark-staining cortex to lighter-staining medullary portions, creating a distinctive microscopic pattern. There are no Hassall's corpuscles, but simply small clumps of epithelioid cells. Adipose tissue is not deposited in the involuting thymus tissue of the mouse. The small thymocytes respond in a manner similar to lymphocytes. The normal lymph nodes vary in total size, shape, and relative size and position

almost complete loss of lymphocytes, causing a marked decrease in size of the node. The naked reticulo-endothelial structure of the node remained, with hemorrhage and unidentifiable cellular debris in the afferent and peripheral sinuses. While at five days after injection almost all of the debris and golden brown pigment were free in the sinuses, at the time of death some of the debris was being engulfed by phagocytic macrophages (Fig. 18).

As a result of the disappearance of all the lymphocytes, the thymuses of these 2-mc. animals showed an estimated 90

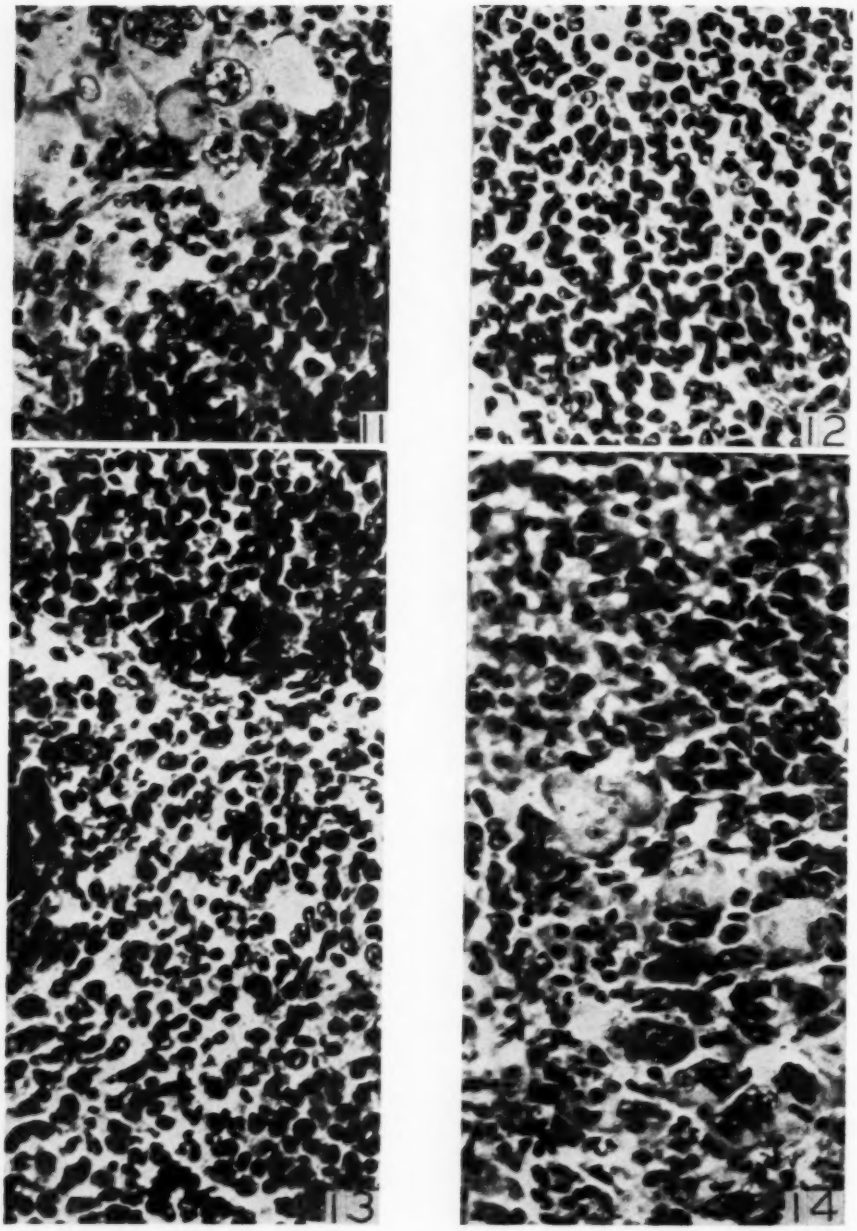
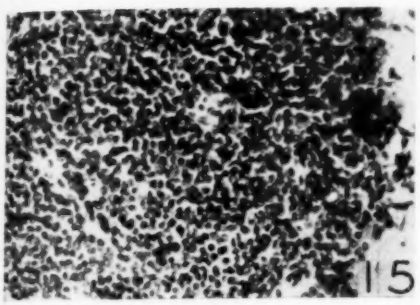


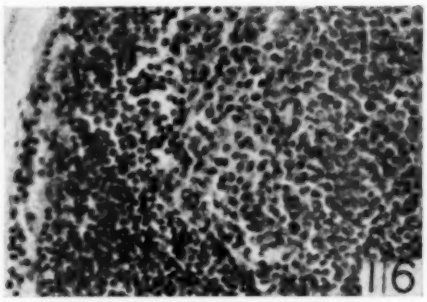
Fig. 11. Spleen ten days after injection of 250 μc. of P^{32}, showing lymphopoiesis returning at edge of white pulp (bottom); degenerated constitutents of red pulp (above). $\times$ *c.*500.

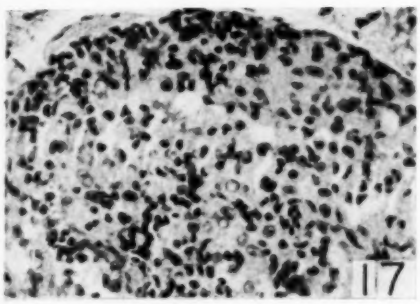
Fig. 12. Spleen twenty days after injection of 250 μc. of P^{32}, showing radial section of well developed germinal center. $\times$ *c.*500.

Fig. 13. Spleen ten days after injection of 250 μc. of P^{32}, showing regenerating lymphoid tissue surrounding previous germinal center, which is now undergoing fibrosis (center). $\times$ *c.*500.

Fig. 14. Splenic red pulp twenty days after injection of 250 μc. of P^{32}, showing evidence of hematopoiesis (above). Myeloid metaplasia is still not marked in this area; degenerated megakaryocytes (center) are still present, with free macrophages engulfing cellular debris. $\times$ *c.*500.







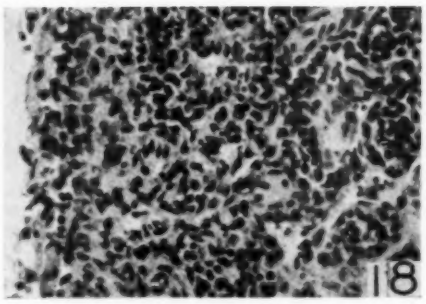
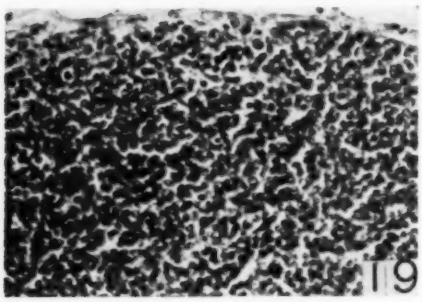
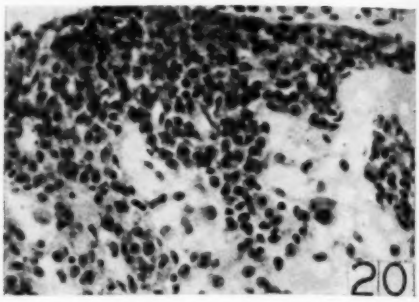


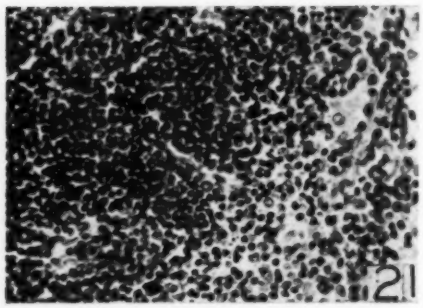
Fig. 15. Normal thymus gland, adult mouse. ×250.
Fig. 16. Normal lymph node section, showing medium-sized lymphocytes in germinal center. × 250.
Fig. 17. Thymus five days after injection of 2 mc. of P^{32}, with no remaining lymphocytes. Note epithelial-like appearance of cortical stroma. ×250.
Fig. 18. Lymph node five days after injection of 2 mc. of P^{32}, showing marked diminution in number of lymphocytes (compare with Fig. 2) and impaired stromal cells. ×250.

per cent decrease in size. The glandular pattern was totally changed. The medullary portions now stained darker and the cortical portions had taken on a pale, almost ephithelial-like appearance, resembling embryonic cords or islands of such tissue (Fig. 17). This change is called an "inversion pattern" by Bloom (2), who describes it as a rather typical x-ray reaction of the thymus.

Two days after injection with 250 μc. of P^{32}, the lymph nodes showed questionable depression of lymphopoiesis, which by four days was definitely established by absence of mitoses and reduction in concentration of lymphocytes of all sizes to half of normal. The afferent sinuses were empty and the lymphatic stroma almost bare. By seven days the reticulum was exceedingly prominent; no germinal activity or evidence of recovery was manifested. The bulk of the gland was composed of a thickened endothelial meshwork enclosing columns of small plasma cells and single, apparently uninjured primitive reticular cells but no lymphocytes. At nine days the lymphocytes made their return appearance in the peripheral sinuses only. The first real evidence of regeneration was a very small amount of lymphopoiesis in the more central parts of the node eleven days post-injection, and this was found in a few nodes only. The greater number of nodes were composed of fibroblasts and plasma cells clumped in an extremely condensed reticulum. By sixteen to twenty days there was diffuse, scattered proliferation of the lymphocytes in a few nodes, but many of the nodes appeared permanently damaged. By 50 days there had been no further proliferation of lymphocytes. Occasionally a focus







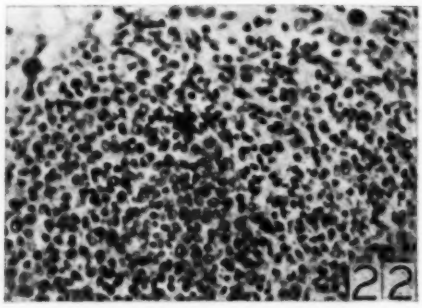


Fig. 19. Thymus twenty days after injection of 250 μc. of P^{32}, showing regenerating lymphocytes with mitotic figures and return to approximate normal. ×250.

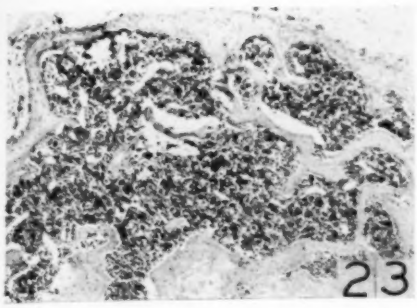
Fig. 20. Lymph node twenty days after injection of 250 μc. of P^{32}, showing vacant sinuses, plasma cells, condensed stroma, absence of lymphocytes, and some fatty replacement of stroma. ×250.

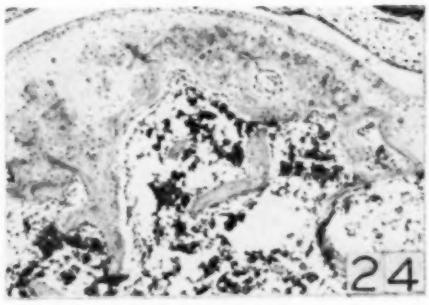
Fig. 21. Thymus fifty days after injection of 250 μc. of P^{32}, showing slightly more intense and localized development of lymphocytes than normal (compare with Fig. 15). ×250.

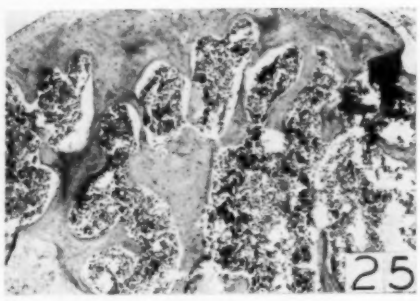
Fig. 22. Lymph node fifty days after injection of 250 μc. of P^{32}, showing large lymphocytes developing in peripheral follicle. There are only a few small scattered adult lymphocytes present in the sinuses (compare with normal, Fig. 16). ×250.

of extramedullary hematopoiesis was found as a late effect (Fig. 20).

Two days after injection of 250 μc. of P^{32}, the thymus, in contrast to the lymph nodes, showed an estimated 50 per cent reduction in numbers of viable lymphocytes. By five days the gland showed the embryonal epithelial appearance described above and seen in Figure 17. In addition, there were prominent, large, rounded intact reticular cells, some of which were phagocytizing blood pigment and debris. The over-all size of the gland was reduced immediately about half, but resumed almost normal size and appearance in about ten days. At this time the medium-sized lymphocytes were seen actively dividing in a widening cortical region, which again became dark-staining because the cells were tightly packed and of uniform size and age. The lighter-staining medullary portions were correspondingly narrowed or encroached upon by this activity in the cortex. By twenty days, the thymus was somewhat enlarged (estimated one and a third to one and a half times normal). The demarcation between cortex and medulla was distinct, but the relation of cortical to medullary portions was still not completely restored, the cortex being about twice the normal thickness and the medullary parts thinned in proportion (Fig. 19). Fifty days after injection with this dose the thymus was normal in all respects (Fig. 21). This is in contrast to the lymph nodes, which at this time, after the same dosage, were either completely destroyed or but slightly regenerated. Figure 22







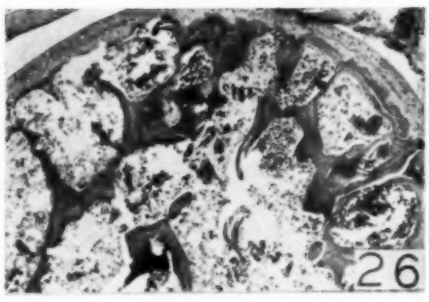


Fig. 23. Normal mouse bone marrow. ×50.
Fig. 24. Mouse bone marrow ten days after injection of 250 μc. of P^{32}. Note acute depletion of cellular marrow components. ×50.
Fig. 25. Marrow structure shows very slight effect ten days after injection of 25 μc. of P^{32}.
Fig. 26. Increased bone marrow cells and few islands of original cells remaining twenty days after injection of 250 μc. of P^{32}. ×50.

shows maximum lymph node recovery.

The lymph nodes of animals given 25 μc. of P^{32} showed no germinal centers and no mitoses ten days following injection. The general framework of the nodes remained intact, but there were plasma cells and reticular cells where there had been tightly packed lymphocytes. The effect was almost as marked as that caused by the lethal 2-mc. dose.

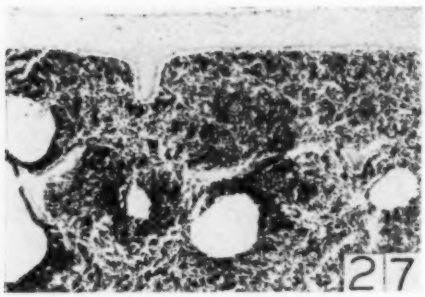
Again, in contrast, the thymus glands of the same animals showed increase in size and activity ten days post-injection. Mitoses were frequent in the largest lymphocytes. This lymphopoietic hyperplasia was diffuse throughout the medulla and cortex, rather than restricted to the cortex as is the lymphopoiesis in the controls.

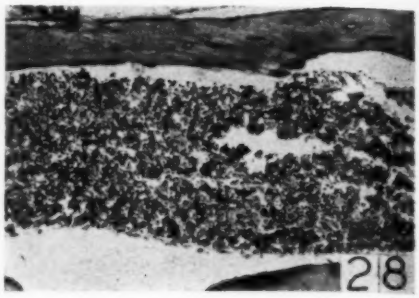
By ninety days the lymph nodes of this group showed very little regeneration. They were shrunken and flattened, and contained a few lymphocytes, thickened endothelial cords including prominent fibroblasts, many plasma cells, and brown pigment-containing reticular cells.

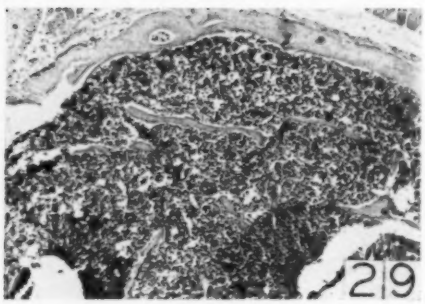
At the same time (ninety days), the thymus, in contrast, was extremely hyperplastic, most glands being enlarged to about three times normal size. Many mitoses of the middle-sized lymphocytes were seen throughout the somewhat hyperplastic and cellular cortex. In one instance well defined extramedullary myelopoiesis was noted, with the presence of megakaryocytes.

BONE AND BONE MARROW

It will be recalled that all the animals given 2 mc. died or were moribund before or by the sixth day after injection. All 12 animals showed exactly the same bone marrow picture, *viz:* (1) partial depletion







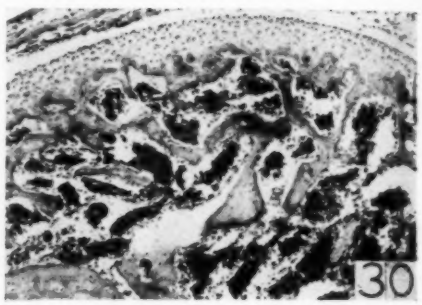


Fig. 27. Foci of concentrated young forms appearing largely near central shaft location, eighty-four days after injection of 25 μc. of P^{32}. ×50.

Fig. 28. Twenty days after injection of 250 μc. of P^{32}. While the ends of bone are still devoid of hematopoiesis (see Fig. 26), the medulla of the femoral shaft in the same animal shows diffuse resumption of hematopoiesis. ×50.

Fig. 29. Lymphomatous bone marrow developed eighty-four days after injection of 25 μc. of P^{32}. ×50.

Fig. 30. Five days after injection of 2 mc. of P^{32} (fatal dose). Condensed bone marrow reticular structure and markedly pyknotic and acutely damaged cellular content. ×50.

of all types of cells in the marrow spaces; (2) marked damage to and condensation of the remaining cells; (3) severe hemorrhage and congestion; (4) loss of characteristic reticular pattern of the stroma, due partly to prominence of the fibroblasts. This picture was consistently seen in the femurs and in the vertebral marrow spaces (Fig. 30). No effects on bone itself could be discerned after this brief exposure.

Progressive radiation changes were best demonstrated in the bone marrow of animals injected with 250 μc. of P^{32}. Two to four days after injection, the marrow had decreased to 50 or 70 per cent of normal volume, and was partially replaced by profuse hemorrhage and cellular debris. The megakaryocytes had pyknotic nuclei and large cytoplasmic vacuoles or rings. At eight to nine days the cellular content of the bone marrow was reduced even further, to about 10 per cent of normal. At ten days in almost all animals injected with 250 μc. there was maximum injury of the marrow with no evidence of repair. The residual cells consisted of clumps of 10 to 15 uniformly dark, flattened, angular cell remnants thought to belong to the red cell series; occasionally a shrunken megakaryocyte could be seen; there were marked hemorrhage and much extracellular golden pigment which had the staining characteristics of hemofuscin. The reticular cells were prominent and dispersed on a scant stroma containing ovoid or slightly elongated fibrocytes. There were also occasional plasma cells and small basophilic dark cells resembling degenerated lymphocytes. The repair phase was manifest by thirteen days, at which time small

TABLE III: MAXIMUM INJURY AND REPAIR RELATIONS OF RETICULO-ENDOTHELIAL AND HEMATOPOIETIC TISSUES

250 μc. LD/50, 20 Days	2–5 Days	5–10 Days	10–15 Days	15–20 Days	50+ Days
Thymus	*Maximum injury. Lymphocytes reduced 90%*	Beginning repair and lymphopoiesis	Normal lymphopoiesis	Gland hypertrophied 1 1/3 of normal and hyperplastic	Normal to slightly hyperplastic
Spleen	Depression of lymphopoiesis	*Maximum injury. Absence of all lymphocytes. 1/3 normal size*	Beginning return of lymphopoiesis. 1/2 normal size	Beginning myelopoiesis. Increased over normal size	Normal except for slight increase in size
Bone marrow	50–70% of bone marrow destroyed	*Maximum injury. 90% bone marrow destroyed*	Beginning resumption of erythropoiesis and myelopoiesis	Bone marrow regenerated to 90% of normal amount	Slightly hyperplastic
Lymph nodes	Little visible gross or histologic change	*Maximum injury. Almost all lymphocytes destroyed*	Plasma cells and fibrosis replacement. Few circulating lymphocytes	Beginning lymphopoiesis	Partial return to a scattered type lymphopoiesis

clumps of reticular cells, small binucleated megakaryocytes, and a few young granulocytic forms could be distinguished. These cells were scattered about the marrow in a haphazard fashion. Injured cells and the above described pigment still remained, only partially engulfed by macrophages. The hematopoietic foci were limited to the mid-shaft of the long bones and to the vertebrae and even by eighteen days there was no definite resumption of hematopoiesis in the ends of the long bones. This is consistent with previous observations (1) as to the bone-localizing and concentrating properties of P^{32} about the metaphysis and growing ends of bone. (Compare Fig. 26 with Fig. 28.)

At twenty days the marrows of all animals receiving 250 μc., except one, showed well developed foci of hematopoiesis throughout the shafts of the long bones and to a lesser extent in the metaphyses. Myelopoiesis seemed to be producing about one-third granulocytic forms and about two-thirds erythrocytic forms. At this time the total volume of the marrow cells was estimated to be 90 per cent of normal.

The bone marrow at ten days following injection of 25 μc. showed uniform diffuse reduction in its cellular content, varying from about 10 to 50 per cent, and averaging about 20 per cent (Fig. 25). Evidence of cellular destruction and degeneration was scarce in mice receiving this dose and was most noticeable in the megakaryocytes. Occasionally a crenated or misshapen cell of the red blood cell series was noted. Hemorrhage into the marrow spaces was moderate. The small amounts of pigment found were iron-containing and presumably derived from hemoglobin. At no time with this dose was injury to the reticular or stem cells noted.

The bone marrow in this group (25 μc.) at eighty-four days (Fig. 27) was invariably somewhat hyperplastic, with all the marrow cell-types participating. This was most marked in the shafts, while the ends of the bone still showed partial depression of marrow activity. The proportion of closely packed, dark, young granulocytic cells seemed increased throughout. There was also an increased number of megakaryocytes, which for the most part were about half normal size. The animal previously noted to have lymphoma involving the thymus and spleen had the same closely packed, large lymphoblasts within the bone marrow to the exclusion of the other cell-types (Fig. 29). No specific radiation effect could be seen eighty-four days post-injection with this dose.

SUMMARY AND DISCUSSION

Part I of a histologic survey of the effects of continuous internal irradiation of mice with varying dosages of P^{32} has been pre-

sented. The time relations of maximum injury and beginning recovery of the reticulo-endothelial and hematopoietic tissues can be seen in Table III.

The tissue showing radiation injury earliest is the thymus, but the thymus also appears to possess a "radioresiliency" in that it returns to normal most rapidly and completely. Splenic tissue and bone marrow appear about the same in respect to sensitivity to P^{32}, but bone marrow is more nearly completely destroyed than splenic tissue by an equal dose. Repair and return of myelopoiesis can be seen in both tissues at ten to fifteen days following injection. The spleen becomes hyperplastic by twenty days, but the bone marrow does not become hyperplastic until some time later, again no doubt due to the P^{32} retention in the bones.

Lymph nodes are the last tissue to show morphologic recovery from effects of radiation. By eighty-four days lymph nodes still are not completely restored but continue to show a scanty proliferation begun at fifteen to twenty days after injection.

It is interesting to observe in the group of animals given the minimal dose an overgrowth effect in some of the tissues after a preliminary depressive effect. Marked lymphopoiesis, myelopoiesis, and hyperplasia occur, with resultant increase in the size of the spleen, thymus, and amount of bone marrow but not in size of the lymph nodes, which appear permanently damaged and shrunken by this small dose. This causes the lymphoid tissue of the nodes to present a peculiar contrast to its morphologic cousin, thymic tissue, which appears to have a much greater ability to come back after suffering equally severe irradiation damage.

Also of interest is the histologic observation of repair and recovery in the lymphoid tissues and bone marrow. Restoration to almost normal was accomplished in some animals dying because of radiation injury. This was previously noted in irradiation studies in chicks (6) and apparently indicates an irreparable generalized radiation injury which cannot be adequately demonstrated morphologically but causes death in spite of well developed regeneration of these most radiosensitive tissues.

In general, it can be said that destructive effects in the tissues of irradiated mice increase directly with the size of dose of P^{32}, and that the degree of injury and regeneration varies with type specificity of the tissue.

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SUMARIO

Efectos de la Irradiación Interna de los Ratones con P^{32}: Bazo, Ganglios Linfáticos, Timo, Hueso y Médula Osea

Este trabajo representa la Primera Parte de un estudio histológico de los efectos de la continua irradiación interna de los ratones con P^{32}, considerando el bazo, los ganglios linfáticos, el timo, el hueso y la médula ósea. Un grupo de animales recibió 2,000 μc (2 mc.), dosis invariablemente letal; el segundo grupo recibió 250 μc., dosis esta letal para 50 por ciento de los animales en término de dieciocho días; y al tercer grupo se administraron 25 μc., que produjeron sólo

mínimas alteraciones clínicas. El isotopo fué inyectado subcutáneamente en 2 cc. de solución salina isotónica.

El tejido que revela primero lesión irradiatoria es el timo, pero parece poseer "radioelasticidad," pues es el que vuelve a lo normal con mayor rapidez y más completamente. El tejido esplénico y la médula ósea parecen ser aproximadamente idénticos con respecto a sensibilidad a P^{32}, pero la última fué destruída más casi completamente que el primero por una dosis igual. En ambos tejidos ya podían observarse regeneración y retorno de la mielopoyesis a los diez a quince días de la inyección. El bazo ya estaba hiperplástico a los veinte días, pero no sucedió así con la médula ósea sino algún tiempo después, debiéndose esto sin duda de nuevo a la retención de P^{32} en los huesos.

Los ganglios linfáticos fueron el último tejido en revelar reposición morfológica de los efectos de la irradiación. A los ochenta y cuatro días no estaban aun completamente repuestos sino que continuaban revelando escasa proliferación que había comenzado a los quince a veinte días de la inyección de P^{32}.

En el grupo de animales que recibió la dosis mínima, observóse efecto hipertrófico en algunos de los tejidos a continuación de un efecto depresor preliminar, habiendo notable linfopoyesis, mielopoyesis e hiperplasia con el consiguiente aumento de tamaño en el bazo y el timo y de cantidad en la médula ósea, pero no en el tamaño de los ganglios linfáticos a los que pareció esa pequeña dosis lesionar y contraer permanentemente. Esto hace que el tejido linfoideo de los ganglios ofrezca un contraste peculiar a su primo hermano morfológico, el tejido tímico, que parece estar dotado de una capacidad mucho mayor para reponerse después de experimentar lesiones irradiatorias igualmente graves.

Es también interesante la observación histológica de regeneración y reposición en los tejidos linfoideos y la médula ósea, habiendo restitución casi a normal en algunos animales que morían de lesiones irradiatorias. Esto aparentemente indica una irreparable y generalizada lesión irradiatoria cuya presencia no puede demostrarse en forma adecuada morfológicamente, pero que ocasiona la muerte a pesar de la regeneración bien adelanatada de esos tejidos máximamente radiosensibles.

En general, cabe decir que los efectos destructores en los tejidos de los ratones irradiados aumentan en razón directa a la magnitud de la dosis de P^{32}, y que la intensidad de las lesiones y de la regeneración varían conforme a la especificidad por tipo del tejido.

Upper Lobe Bronchial Abnormalities Simulating Significant Pulmonary Tuberculosis

With Seven Illustrative Cases[1]

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AMONG THE PROBLEMS presented in the increasing use of the mass roentgenologic chest survey is the demonstration of certain abnormal upper lobe processes involving the bronchi which may easily be mistaken for significant pulmonary tuberculosis.

Symptomatic and disabling bronchiectasis is predominantly a disease of the lower lobes, but in recent years numerous cases, particularly of the subclinical, mild, or dry type, have been found involving the upper lobes exclusively. Mallory (1) has given a clear-cut analysis of the pathogenesis and pathology, especially as regards the symptomatic disease in the lower lung fields. The bronchiectases, however, do not differ with their location or their etiologic background (2). The microscopic character is the same, too, whether the dilatation is cylindrical, saccular, or ampullar. The essential finding is the destruction of the musculo-elastic layer of the bronchial wall, which is due to a non-specific process.

Bronchial inflammation plus atelectasis or pneumonitis of non-specific type adequately explain the development of most cases of lower lobe bronchietasis. A great many cases of upper lobe bronchiectasis, on the other hand, represent burnt-out reinfection pulmonary tuberculosis; some follow obstructive lesions of the bronchi after healing of an active primary tuberculosis (3, 4), and a still smaller group is secondary to congenital anomalies of the bronchial tree (5). In one of the cases described below, a variation of the bronchovascular pattern in the right upper lobe was mistaken for active pulmonary tuberculosis in this region. Such interesting anomalies often unaccompanied by disease of the accessory or misplaced bronchial branches have recently been described in a discussion of the surgical approach to the bronchopulmonary segment (6, 7).

Although there are no pathological differences between bronchiectasis located in the upper lobes and the disease in the lower lung fields, there are generally recognized clinical differences. Unlike an extensive process of the same sort in the lower lobes, upper lobe bronchiectasis may produce no disabling symptoms during the lifetime of the patient, or the only complaint may be recurrent blood-spitting. Many of these patients expectorate small amounts of mucopurulent sputum, but because of the favorable gravitational location of the disease, the sputum does not accumulate in bronchial pools. Expectoration is free when it is present, it comes in small quantities at a time, with little or no odor, and is not as a rule associated with violent coughing. So undisturbing is the respiratory complaint—sometimes the little sputum in upper lobe bronchiectasis is unconsciously swallowed rather than expectorated—that symptoms referable to the lungs are often elicited only on careful questioning. The nutrition and the general well-being of the patient usually do not suffer. Clubbing of the fingers is unusual.

It is the purpose of this paper to focus attention on the not uncommon finding of upper lobe bronchiectasis and isolated bronchial abnormalities picked up in chest x-ray surveys, often unaccompanied by complaints referable to the lungs. It is

[1] Accepted for publication November 1949.

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reasonable to assume that with similar basal roentgen findings, the examiner would think of bronchiectasis as the most likely cause, even in the absence of symptoms, but with an upper lobe location, significant acid-fast infection is suspected, and in many instances bronchial disease is not even considered. Thus two of the patients described below were sent to a sanatorium with a diagnosis of active pulmonary tuberculosis, and eventually discharged as "arrested cases" of that disease.

The recent history and physical examination are, as a rule, not very helpful in distinguishing silent upper lobe bronchial abnormalities from equally silent pulmonary tuberculosis. Blood-streaked sputum and frank hemoptysis may accompany either condition, but are more common in bronchial disease. Occasionally upper lobe bronchial dilatations may cause the expectoration of large amounts of sputum in a twenty-four-hour period. Recovery of tubercle bacilli in the sputum or gastric contents obviously stamps the case as one of active open tuberculosis, but unfortunately in many active minimal cases positive sputum or positive gastric culture is obtained only with difficulty, if at all. Here one may again plead for the more frequent use of the tuberculin test, especially since many of the patients under consideration are in the younger age period, and a negative test, except in occasional instances upon which we need not dwell here, would point strongly to a non-tuberculous lesion.

There are two other guides to the diagnosis of upper lobe anomalies and bronchiectasis confined to the upper lung fields. If the latter is the result of burnt-out reinfection tuberculosis or the sequela of healed primary tuberculosis, an old history of these conditions may be obtainable. Next in importance to a suggestive history is the careful perusal of the chest film. The radiographic criteria for the diagnosis of upper lobe bronchial abnormalities differ little from those for the same condition in the basal regions. It should not be too difficult to distinguish on the chest film a web-like process or honeycombing whose small irregular areas of translucency are delineated by fine fibrous strands or lines; sometimes, the shadows of the bronchial walls running diagonally across the upper lobe and disappearing abruptly into the parenchyma can be made out. Furthermore, in most instances of upper lobe bronchial abnormalities or bronchiectasis, the abnormal shadows seem to have their origin in and are continuous with the root structure, a radiographic picture not usually seen with minimal infiltrative tuberculosis. Finally, infiltrates, soft and merging imperceptibly with the normal parenchyma, or hard and discrete, are much more likely to indicate tuberculosis than upper lobe bronchial involvement. Where the latter is suspected, the diagnosis is established by upper lobe bronchography, though iodized oil should not be injected until bacteriologic and other studies have ruled out the presence of significant tuberculosis.

The following cases illustrate some of the points raised in the foregoing discussion. Upper lobe bronchograms were obtained in all by the supraglottic method, after the presence of active tuberculosis had been excluded. It may be more than a coincidence that in 6 of these cases the abnormal bronchial shadows were confined to the right upper lobe.

CASE I: K. B., white female, unemployed switchboard operator, was born in 1890. She was well until 1923, when she started to have brisk pulmonary hemorrhages. She was thereupon sent to Liberty, N. Y., where she was under private treatment for pulmonary tuberculosis until 1929. Her sputum had never been positive for tubercle bacilli. There was no family history of pulmonary tuberculosis and no history of contact with the disease.

Since her first hemoptysis, the patient had had frequent colds, which led to weeks of coughing, productive of a negligible amount of sputum. Blood-spitting had occurred from time to time, sometimes amounting to a few mouthfuls. Weight and strength had been maintained, however, with a tendency to plumpness.

In 1942 a brisk hemoptysis caused the patient to seek the services of the Health Department Chest Service. A chest film at this time (Fig. 1A) revealed a honeycombed fibrosis in both shrunken upper lobes, extending out from the upper root regions.

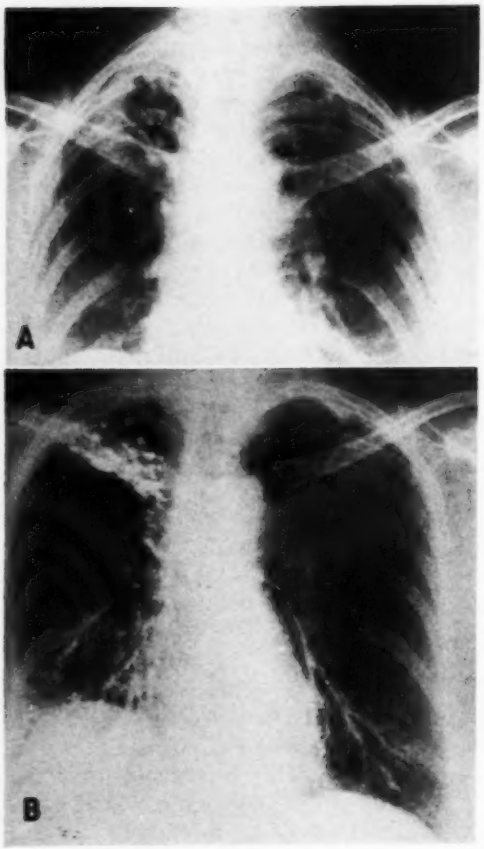

Fig. 1. Case I. A. Roentgenogram, Aug. 24, 1942, showing honeycombed fibrosis in both upper lobes, more marked on the right, extending out from the upper root zones.
B. Saccular bronchiectasis revealed by right upper lobe bronchogram, March 15, 1946.

Numerous sputum examinations and sputum cultures were negative for tubercle bacilli. After about four years of observation, during which serial films showed no change in the extent or appearance of the upper lobe process, bronchography was done during an interval free from hemorrhage. A film obtained following the instillation of iodized oil (Fig. 1B) revealed the presence of saccular bronchiectasis of the right upper lobe bronchial branches.

Comment: If this patient has had pulmonary tuberculosis, it has long since become inactive and burnt out. The residual bilateral upper lobe bronchiectasis is troublesome only because of the recurrent episodes of blood-spitting. The patient has never felt, however, that she was sick enough to require anything more than symptomatic treatment. She was glad to be told, for the first time, after bronchography, that the pulmonary bleeding was due not to reactivation of a pulmonary tuberculosis, but probably to granulations in the involved upper lobe bronchi.

CASE II: J. F., white male of Irish extraction, a laborer by occupation, was born in 1884. He first came under observation in the Washington Heights Chest Clinic on Dec. 9, 1943, because of a recent respiratory infection accompanied by slight fever, lasting about two weeks. His family history was negative and his past history revealed nothing of significance except for frequent colds and easy fatigue. Nothing of note was found on physical examination except for poor nutrition and some clubbing of the fingers. The chest film showed a honeycombed fibrotic lesion confined to the greater part of the right upper lobe, and especially pronounced in the root region. A tentative diagnosis of active pulmonary tuberculosis was made.

The patient was seen thereafter at intervals of several months because of frequent colds, but between times he was completely free of symptoms, and had not lost weight or strength. Serial films taken over a period of two years showed no change in the extent or character of the right upper lobe process (Fig. 2A). Because of the persistence of negative sputum studies, bronchography was done (Fig. 2B), showing the honeycombing to be due to bizarre dilatations of the bronchial tree.

Comment: One was misled into making a diagnosis of active pulmonary tuberculosis on the initial visit of this patient because of the coincidence of the recent respiratory complaints and poor nutrition, together with the finding of a productive lesion in the right upper lobe. As in the previous case, the process, which has remained unchanged over a period of years, could be suspected on careful reading of the initial chest film, when the x-ray criteria for the diagnosis of upper lobe bronchiectasis were borne in mind.

CASE III: T. D., Negro male, born in 1929, first came under observation at the age of seventeen because a chest film taken in a high-school case-finding survey revealed a fuzzy lesion in the upper half of the right upper lobe, clear across from the right upper root (Fig. 3A). At that time, he complained of a slight cough of four weeks duration, but there was no appreciable expectoration. He had not lost weight and was otherwise well. There was no family history of pulmonary tuberculosis and no history of contact with the disease.

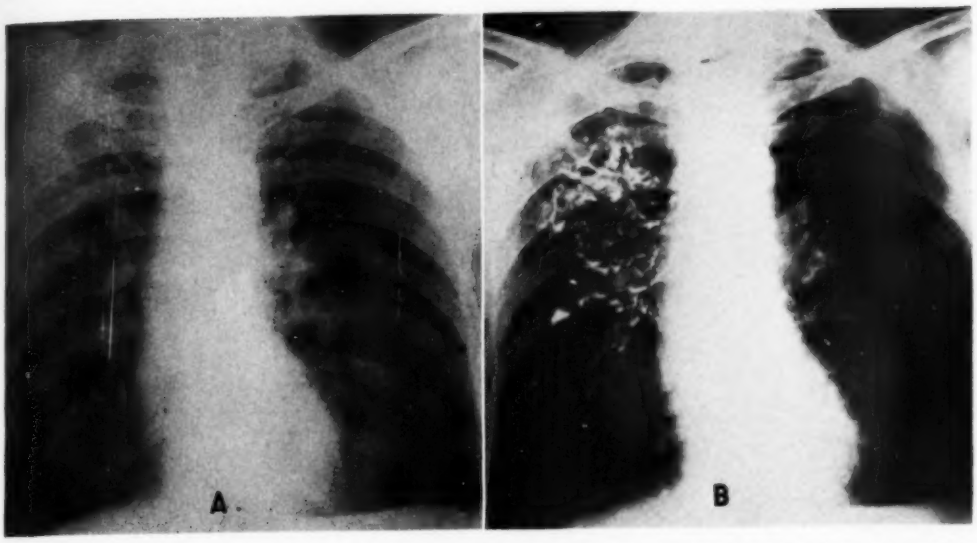

Fig. 2. Case II. A. Roentgenogram, March 12, 1946, showing honeycombed fibrosis in right upper lobe, especially in right root region. The complete continuity of the process is not characteristic of recent active pulmonary tuberculosis.
B. Bizarre bronchial dilatations of all upper lobe branches, demonstrated bronchographically, April 17, 1946.

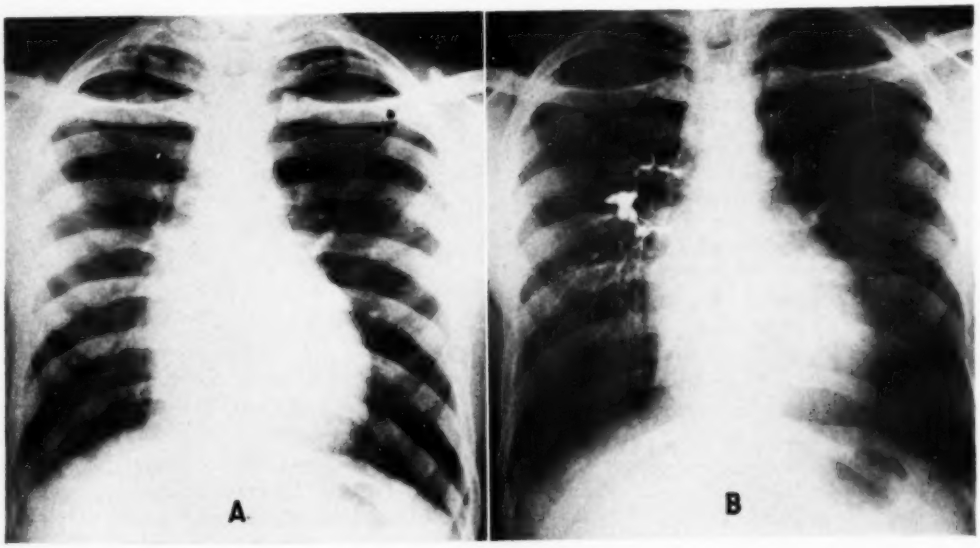

Fig. 3. Case III. A. Roentgenogram, March 21, 1946, showing fuzzy lesion in upper half of right upper lobe.
B. Bronchogram, Nov. 27, 1946, showing bizarre widening and distortion of right upper lobe bronchial branches. Congenital anomaly?

The patient had had a node removed from his neck in early childhood. Three years before admission he made an uneventful recovery from a stab wound in the left chest, which had led to a traumatic pneumothorax.

There were no remarkable findings on physical examination and the lungs were clear. The weight was slightly below normal. Although two sputum reports were negative, a diagnosis of pulmonary tuberculosis was made, and the boy was sent to a sanatorium, where he stayed for six months. In that institution, sputum and gastric secretion were

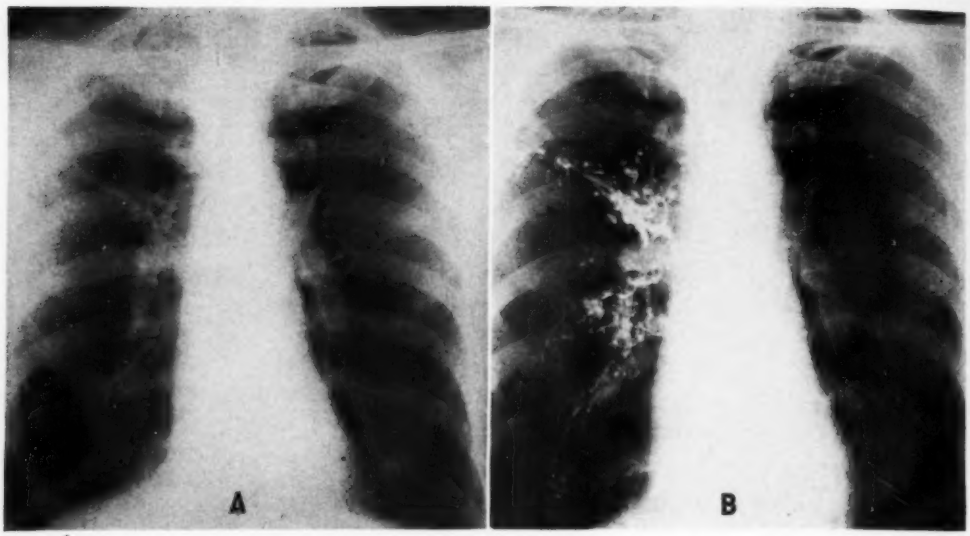

Fig. 4. Case IV. A. Roentgenogram, June 29, 1942, showing a broad band of honeycombed fibrosis extending from the hilus across the right upper lobe. The walls of a small bronchus "cut diagonally" can be clearly seen at the level of the sixth rib posteriorly.

B. Bronchogram, Feb. 1, 1946, showing saccular distortions of bronchial branch extending out from right upper root.

repeatedly negative for tubercle bacilli on smear and culture. The x-ray findings remained unaltered. The patient was on an ambulatory regime during his entire stay in the sanatorium and signed out against advice with a diagnosis of "chronic pulmonary tuberculosis, minimal, quiescent." The appearance and the behavior of the lesion gave rise to the suspicion that abnormalities of the bronchial tree could account for the picture. Bronchography was thereupon performed, and the incompletely filled upper lobe branches showed bizarre configurations (Fig. 3B).

Comment: The etiology of this unusual bronchial picture is of course uncertain, but among the possible causes is a congenital anomaly of the bronchi.

CASE IV: A. G., white male, a shoe salesman, was born in 1888. He was 54 years old when referred to the Clinic on March 15, 1942, because of frequent colds accompanied by cough and expectoration of moderate amounts of non-odorous sputum which had never been bloody. He had been in excellent health between respiratory infections. His past history and family history were not significant.

No abnormal lung findings were elicited on physical examination. The fingers were not clubbed. A chest film taken on June 29, 1942 (Fig. 4A) revealed a broad band of honeycombed fibrosis extending diagonally across the right upper lobe from the hilus; the outlines of a bronchus "cut diagonally" are seen at the level of the sixth posterior rib.

This patient was seen at intervals of several months for a total period of four years. His only complaints during this time were those associated with occasional colds, which lasted only a few days. Serial chest films showed no alteration in the lesion throughout this period. Numerous sputum examinations were negative for tubercle bacilli. A bronchogram obtained Feb. 1, 1946 (Fig. 4B) showed the fibrotic area to contain some dilated and abnormally distributed bronchial branches

Comment: The writer has come across this picture in not a few asymptomatic individuals. It could well represent the end-result of acute or chronic inflammatory parenchymal disease, including tuberculosis, occurring long before. It has been seen more commonly on the right than on the left side. It is in most instances little cause for concern and will neither progress nor produce disabling symptoms in the future.

CASE V: W. W., Negro male, a laborer, was born in 1919. He was first seen on Dec. 3, 1943, because a chest film taken prior to army induction disclosed a right upper lobe lesion. This had the appearance of a branching productive process, extending out from the right upper root and invading the entire right upper lobe (Fig. 5A). At that time the young man was practically asymptomatic.

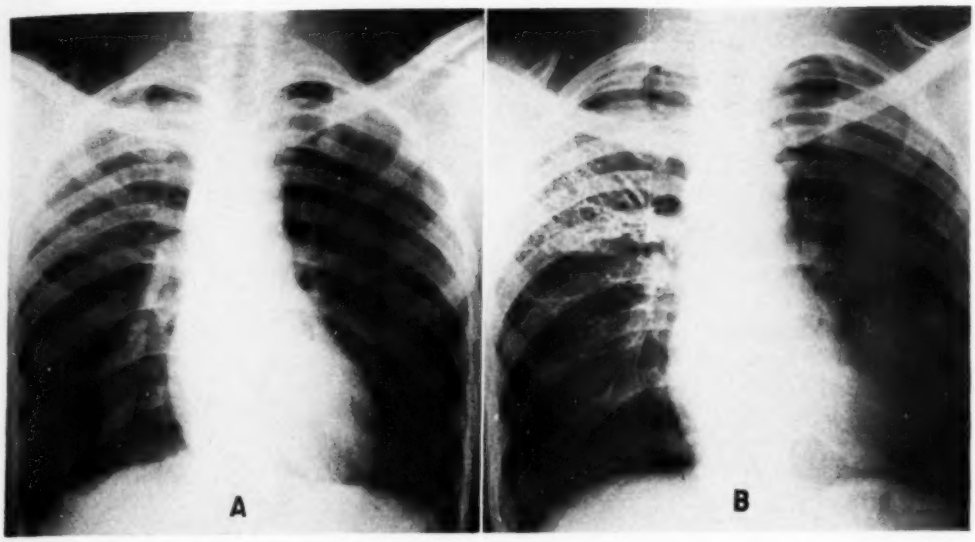

Fig. 5. Case V. A. Roentgenogram, Dec. 13, 1943, showing fuzzy arborization extending from the right upper root region in fan-like fashion throughout the right upper lobe.
B. Bronchogram, March 18, 1944, showing arborization to be due to abnormal bronchial branching.

There was nothing of significance in his family or past history. At the initial examination, the tuberculin test was negative (1:100 O.T.). Several sputum examinations were done, but no tubercle bacilli were found. A bronchogram (Fig. 5B) disclosed the presence of anomalous branching of the right upper lobe bronchi, which were not dilated. This unusual arborization accounted for the abnormal shadow seen on the admission film. The patient was thereupon discharged as requiring no further observation or treatment.

Oddly enough, more than four years later, this patient was sent to another clinic for a chest film because his wife had just been hospitalized for active open pulmonary tuberculosis. He was again asymptomatic. A chest film taken on May 17, 1947, disclosed a process in the right upper lobe similar in extent and character to that described in 1943. The location of the lesion, together with the history of exposure and the patient's race, caused the examiner to label the case as one of active reinfection pulmonary tuberculosis, the previous work-up not being obtainable at that time. The patient was thereupon sent to a sanatorium, where he stayed nine months. During this period, numerous sputum and gastric cultures were negative for tubercle bacilli, but the tuberculin test was now positive (1:10,000 O.T.). He was discharged from the sanatorium in good physical condition, with a diagnosis of arrested minimal tuberculosis.

Comment: This patient spent needless time in an institution, where he was exposed to tuberculosis, because of an unhappy chain of circumstances, and above all because the examiner had a one-track mind regarding upper lobe lesions. As was to be expected, this congenital bronchial anomaly gave an unchanging roentgen picture over a course of years, as the patient had already reached adulthood when the initial chest film was taken.

CASE VI: M. L., white female, a native of Colombia, S. A., was born in 1908. She was well and had no complaints when a film obtained in a tuberculosis case-finding survey, June 11, 1948 (Fig. 6A), disclosed a dense triangular shadow with the apex at the lung root, and the base containing parallel fibrous strands that vanished into the periphery of the right upper lobe. The family and past history were negative. Physical examination revealed nothing remarkable except for poor nutrition. The tuberculin test (1:10,000 O.T.) was positive. Several sputum examinations were negative for tubercle bacilli. A bronchogram, July 2, 1948 (Fig. 6B), shows the previously described productive process to be the framework of a grape-like group of distorted, moderately dilated inferior branches of the right upper lobe bronchus.

CASE VII: F. P., white male, aged 50, was asymptomatic. A routine chest film, March 10, 1949 (Fig. 7A), showed almost parallel fine strands extending from the root into the right mid-lung field at the level of the right third anterior interspace. The family and past history were negative

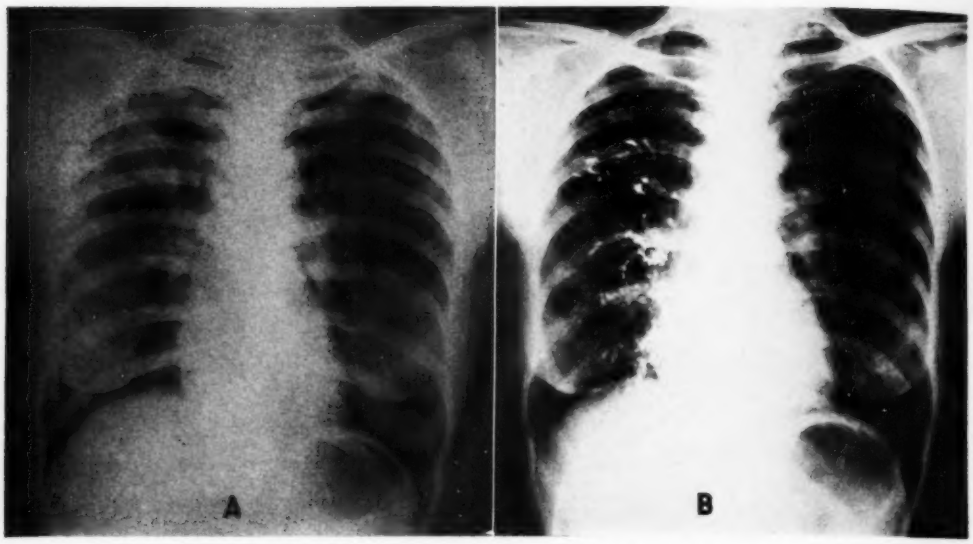

Fig. 6. Case VI. A. Roentgenogram, June 11, 1948, showing well defined triangular shadow, at the base of which telltale parallel fibrotic strands merge into the peripheral parenchyma of the right upper lobe.
B. Bronchogram, July 2, 1948, showing the productive process to be the framework of a grape-like group of distorted, moderately dilated inferior branches of the right upper lobe bronchus.

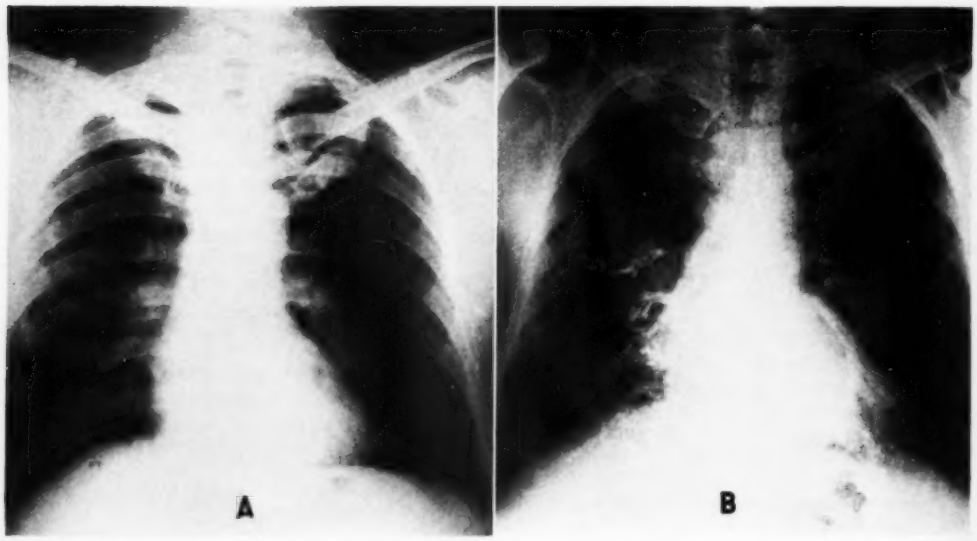

Fig. 7. Case VII. A. Roentgenogram, March 10, 1949, showing almost parallel strands extending from right root region into the right mid-lung field at the level of the third anterior interspace.
B. Bronchogram, March 16, 1949, which explains the fine "fibrotic" process as due to dilatation and distortion of an inferior branch of the right upper lobe bronchus.

and physical examination revealed no abnormalities. A bronchogram, March 16, 1949 (Fig. 7B), shows this abnormal shadow to be due to distortion and dilatation of an inferior branch of the right upper lobe bronchus.

SUMMARY

1. With the increasing practice of routine chest examination, many heretofore unseen bronchopulmonary shadows

are being uncovered in apparently healthy individuals.

2. Upper lobe abnormal bronchial disease or bronchial anomalies may cast x-ray shadows simulating significant pulmonary tuberculosis. The criteria for diagnosing such upper lobe abnormalities are pointed out.

3. These bronchial abnormalities change very little radiographically in the course of years following their accidental discovery in the mature person.

4. As a rule they produce little or no disability.

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SUMARIO

Anomalías de los Bronquios y Lóbulos Superiores Simulando Tuberculosis Pulmonar Significativa. Siete Casos Típicos

Entre los problemas planteados por el empleo creciente de las encuestas roentgenotorácicas colectivas figura el hallazgo de ciertos procesos anormales de los lóbulos superiores que afectan los bronquios y pueden ser confundidos fácilmente con tuberculosis pulmonar significativa. Esto ha sucedido a menudo con bronquiectasia del lóbulo superior y con anomalías bronquiales aisladas.

Los auxiliares del diagnóstico diferencial comprenden: la reacción a la tuberculina, la historia temprana en ciertos casos de bronquiectasia debidos a una "extinta" tuberculosis de reinfección, y el cuadro roentgenológico.

La radiografía revela un proceso membranoideo o apanalado con irregulares zonillas translúcidas demarcadas por finas hebras o líneas fibrosas. En la mayor parte de los casos, las imágenes anormales parecen tener su origen en, y ser continuas con, el tejido de las raíces. La broncografía, una vez excluída la tuberculosis con estudios bacteriológicos y de otro género, establece el diagnóstico.

En los enfermos de edad varía poco el cuadro radiológico en el transcurso de los años. La incapacidad imputable a las lesiones es poca o nula.

Comunícanse siete casos.

Benign Gastric Ulcer of the Greater Curvature[1]

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BENIGN ULCERS of the greater curvature of the stomach are infrequent. In a review of the literature up to 1935, Matthews (16) collected 22 such cases, but listed only 10, including 2 of his own, in which there was adequate histologic confirmation. Since then, 14 additional proved cases have appeared (4, 5, 6, 8, 11, 12, 15, 17, 18, 19, 20, 22, 24). These with the 2 to be reported here bring the total to 26.

Both of the cases to be described were encountered during the same month. A review of the records of the Jewish Hospital of Brooklyn disclosed no similar observations among 87 cases of gastric ulcer examined at necropsy, nor among 100 surgical specimens of this lesion examined between 1935 and 1948. The apparent incidence is thus about 1.0 per cent of all ulcers of the stomach. This figure is in general agreement with that of Clagett (7). Other investigators with wide experience, as Golden (9), Kirklin (13), and Lahey (14), have stated that they have never observed a benign ulcer of the greater curvature. The actual incidence of the lesion, therefore, cannot be estimated, aside from the obvious fact of its rarity. Holmes and Hampton (10), Bowers and Rivers (2) and Allen and Welch (1) reported that all greater curvature ulcers seen by them were malignant.

REPORT OF CASES

CASE I: T. B., a 65-year-old woman, had had repeated attacks of coronary thrombosis during the past five years. About three months before admission she began to complain of a feeling of fullness about one hour after meals. This subsided for about seven weeks, but recurred two weeks before she entered the hospital. At that time, pain in the right lower quadrant radiating to the right upper abdomen appeared. There was no nausea, vomiting, hematemesis, anorexia, diarrhea, or melena. The appetite was good and the weight had been constant for the past year.

Physical examination failed to disclose any abnormality. A trace of blood was found in the stool. Gastric analysis showed a one plus benzidine reaction in the first two specimens but was otherwise normal.

Radiologic examination of the stomach revealed a constant circumscribed indentation at the junction of the middle and distal thirds of the greater curvature, which was interpreted as a small polypoid lesion. With compression, the rugal folds leading to this deformity were seen to be thickened and somewhat convergent, and a small crater was found in the upper aspect of the defect. The most likely diagnosis was considered to be a small neoplasm with an ulcer crater.

At operation a hard, indurated area was palpated along the greater curvature. The stomach was opened and an ulcer about 1.3 cm. in diameter and 0.3 cm. deep was seen. No lymph nodes were felt and the liver was normal. A partial gastric resection was performed.

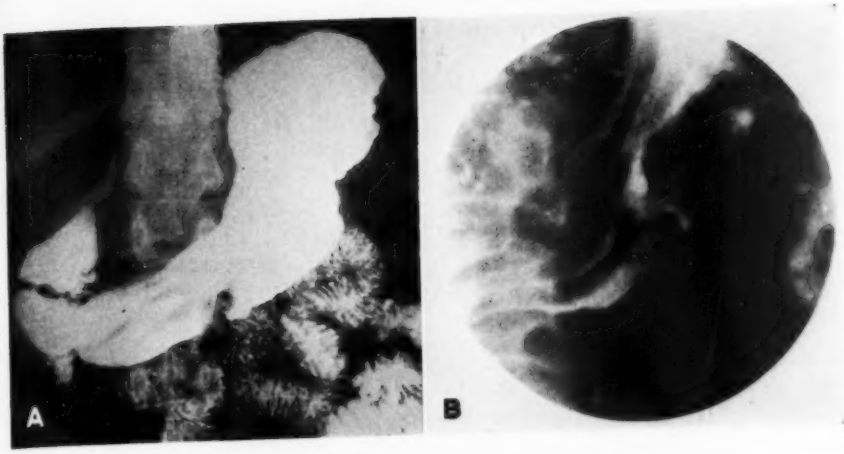
The external surface of the removed specimen was smooth and glistening. On opening the stomach the rugal folds were found to be enlarged and to converge on an ulcer along the greater curvature. The crater measured 1 cm. in diameter and 0.5 cm. in depth. Its edges were elevated, slightly round and firm, and its base was pinkish gray.

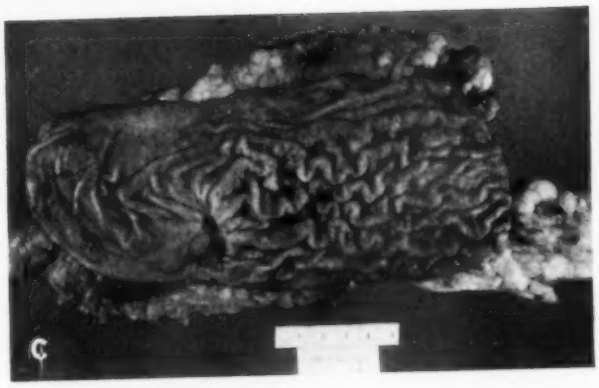
Microscopic examination was made in great detail by Dr. David Grayzel and Dr. Philip Rosenblatt. Numerous sections were taken. The chief and parietal cells were well demarcated. In some preparations the mucosa was denuded and the ulcer base was formed by granulation tissue densely infiltrated with polymorphonuclear leukocytes and mononuclear cells. In none of the preparations was there any evidence of malignancy.

Fourteen months later the patient's attending physician reported that she was in excellent physical condition.

CASE II: F. B., a 43-year-old man, had had a productive cough for eight months before he entered the hospital, with hemoptysis on two occasions. A tumor of the right lung had been found on roentgenographic examination of his chest six weeks before admission. For about one month there had been sour eructations and dyspepsia, and the patient had noticed that his stool was black on several occasions.

[1] From the Radiologic Service of M. G. Wasch, M.D., The Jewish Hospital of Brooklyn, Brooklyn, N. Y. Accepted for publication in December 1949.





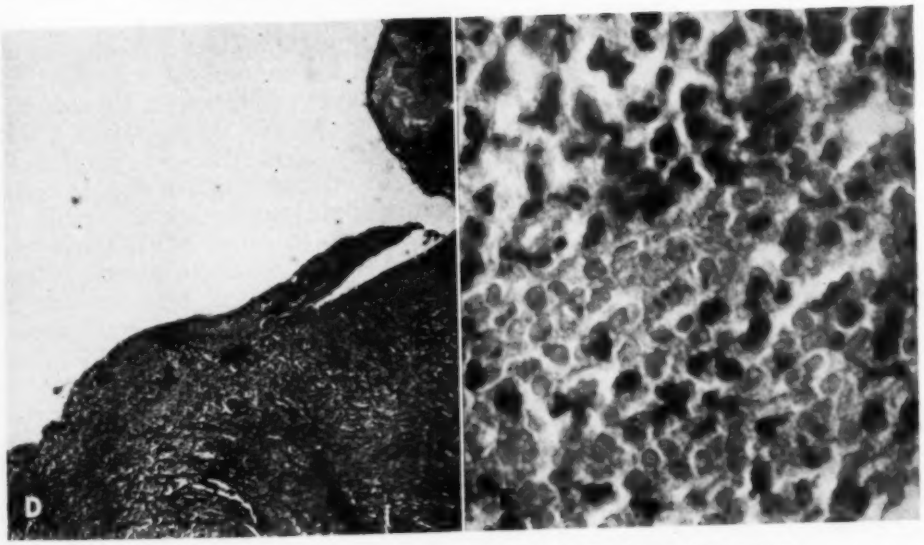


Fig. 1. Case I. A. Prone view of stomach, showing filling defect in the greater curvature.
B. Erect spot film with compression, showing barium fleck retained in crater and thickened rugal folds leading to the defect.
C. Operative specimen, showing convergence of rugal folds towards the ulcer crater.
D. Tissue from ulcer edge.
E. Same section, showing inflammatory changes. High magnification.

Physical examination did not help, and the laboratory examinations were negative aside from showing a faint trace of blood in all specimens taken for gastric analysis.

Radiologic examination of the gastro-intestinal tract showed a rather smooth, moderate narrowing of the pylorus. A pouch-like deformity was present in the distal portion of the greater curvature, with thickened rugal folds leading to the pouch. An atypical gastric ulcer was diagnosed, although neoplasm was not excluded.

At operation, a rigid area about 3 cm. in diameter was found adjacent to the greater curvature at the pylorus, and a partial gastric resection was performed. No lymph node metastases were found, and the liver and adjacent viscera were normal. The chest was then explored and an inoperable tumor of the right lung was encountered. The patient soon expired. The order of operation was decided upon because it was felt that the clinical diagnosis was carcinoma of the stomach with pulmonary metastases.

Pathologic examination of the resected stomach showed its external surface to be pink, smooth, and glistening except for an area on the greater curvature about 3 cm. from its distal end, where the serosa was red, thickened, and adherent. On opening the stomach an ulcer crater 2.2 × 0.8 × 0.8 cm. was seen, corresponding to the site of serosal change. The ulcer edges were sharp, and the mucosa was not fixed. The base consisted of firm gray tissue. For a distance of 1.5 cm. around the ulcer the mucosa was congested and edematous. Beyond this the rugal folds converged toward the crater, becoming rather scant as they approached this point. On cut section the ulcer base was seen to extend completely through the muscularis and to be composed of subserosal fat.

Microscopic examination was made with meticulous care and numerous sections were taken. There was no evidence of malignant change. The many preparations disclosed a deeply penetrating ulcer, the base of which was made up of fibrous tissue densely infiltrated with inflammatory cells.

At necropsy a carcinoma of the right upper lobe main bronchus was found. Metastatic deposits were found in the lungs, mediastinum, kidneys, and superior vena cava. No metastases were found in the gastro-intestinal tract or in the tissues adjacent to it.

COMMENT

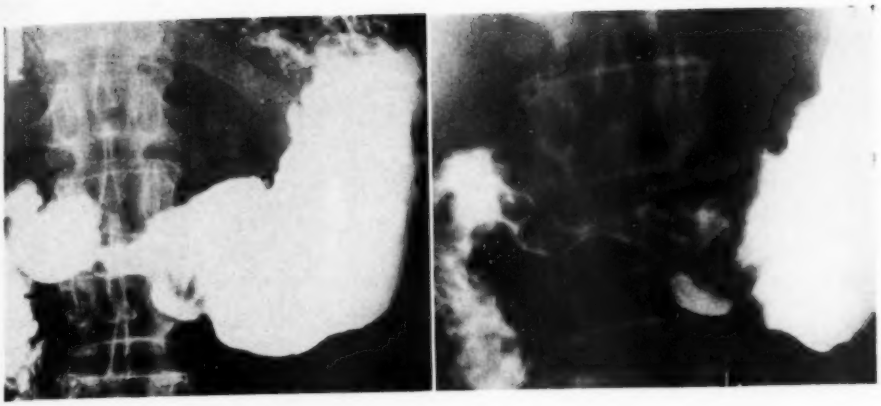
The radiologic appearance of a gastric ulcer depends on the morphologic changes existing at the time of examination. A shallow pocket may be manifested only by a small niche and evidence of irritability, with or without rugal thickening in its vicinity. As the crater deepens, the niche may become larger and protrude beyond the confines of the stomach, but this does not necessarily indicate the size of the lesion. Its depth may vary with the degree of penetration, reaction of the mucosal borders, the restraining influence of adjacent tissues, and detritus within the crater. The rugal folds may be thickened and converge toward the ulcer. Such convergence was observed in the recently reported cases of Matthews (16), Blum (4), Campbell (5), Cave (6), Kennedy and Beck (12), Levin, Kirsner, Clark, and Palmer (15), and Preiss (18), and in the cases reported here.

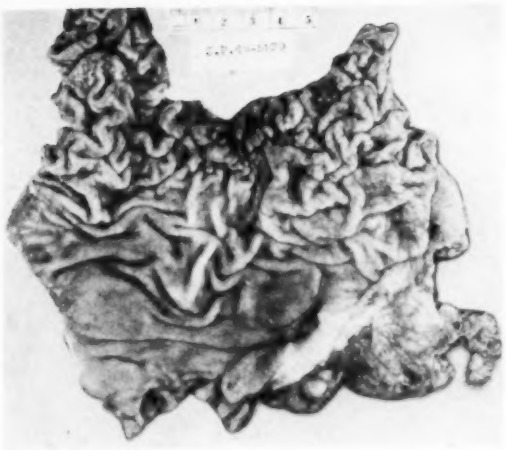
A considerable degree of deformity of the pylorus was described with benign greater curvature ulcer by Matthews (16) in his second case, by Cobeau, Bonte and Dumez (8), by Russell (20), by Williams (24), by Popović (17), and by van Buchem (22). In these the deformity was indistinguishable from pyloric neoplasm.

The higher probability that a greater curvature lesion is malignant must constantly be kept in mind, and surgical intervention is the treatment of choice even when the radiologic findings suggest the possibility of a benign ulcer. Some authors have reported healing of greater curvature ulcers under medical treatment alone (Campbell, 5; Buckstein, 3), and Stevenson and Yates (21) illustrated a case of syphilitic ulcer of the distal third of the greater curvature which disappeared after thirty days of antisyphilitic therapy. These authors recommended surgical intervention for all cases of roentgenologically diagnosed benign gastric ulcer, even though in their series of 91 adequately followed cases the roentgenologic report of a benign lesion was accurate in 93.4 per cent. The latter figure refers to lesser curvature ulcers. Allen and Welch (1) and Wiley (23) have likewise urged surgical treatment for greater curvature ulcers.

SUMMARY

Two histologically verified cases of benign ulcer of the greater curvature are described. One patient survived fourteen





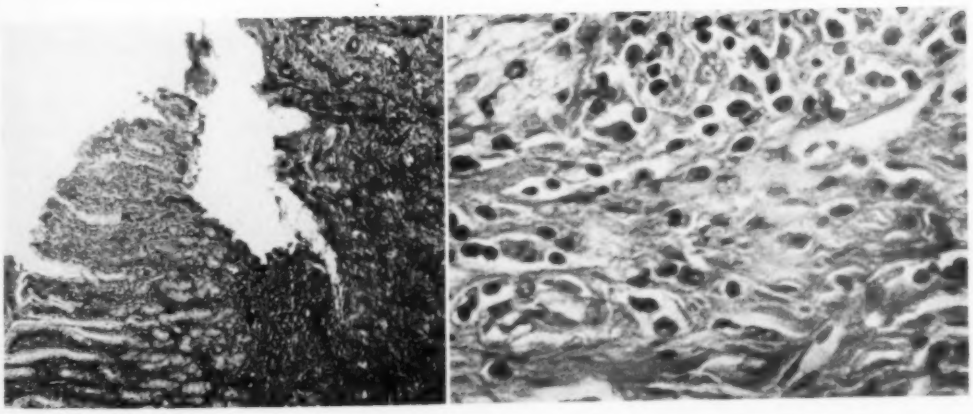


Fig. 2. Case II. A. Prone view of stomach showing diverticulum-like projection from the greater curvature, with rugal folds leading to the defect.
B. Same view with compression.
C. Removed specimen, showing ulcer crater and convergence of rugal folds.
D. Tissue from ulcer edge.
E. Same section, showing inflammatory changes. High magnification.

months after operation and is in good health at this time. The second had a concomitant pulmonary tumor which was inoperable. It is suggested that the presence of an ulcer crater on the greater curvature toward which the rugal folds converge may be benign, but operative intervention is nevertheless urged.

NOTE: We acknowledge with thanks the aid rendered in the pathological aspects of these cases by Dr. David Grayzel and Dr. Philip Rosenblatt.

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SUMARIO

Ulcera Gástrica Benigna de la Curvatura Mayor

Los dos casos descritos son de úlcera benigna de la curvatura mayor del estómago, comprobada histológicamente. Un enfermo ha sobrevivido la operación catorce meses y disfruta ahora de buena salud. El segundo tenía un tumor pulmonar concomitante, que era inoperable. Indícase que la presencia de un cráter de úlcera en la curvatura mayor hacia el cual convergen los pliegues de las arrugas puede denotar benignidad, pero se aboga, a pesar de eso, por la intervención cruenta.

Accessory Sacroiliac Articulations with Arthritic Changes[1]

LEE A. HADLEY, M.D.

Syracuse, N. Y.

AN INTERESTING condition of some clinical importance has been demonstrated on the posterior surface of the sacrum. Accessory articulations between the ilium and sacrum may occur, and in certain cases show well advanced arthritic changes. One or two such joints may appear on either or both sides.

ANATOMY OF THE SACROILIAC JOINT

The sacrum is normally formed by the fused elements of five primary vertebral segments. The alae, in front, originate from the costal elements. Posteriorly, the transverse processes join to form the crests which are lateral to the posterior sacral foramina. The ear-shaped, cartilage-covered, articular surfaces arise from the anterior portions of the first two segments. These correspond to the alae of the sacrum. There is a sacral tuberosity above and behind the articular surface on either side.

That portion of the innominate bone posterior to the iliac fossa faces toward the sacrum. About one-third of this medially directed surface—the so-called auricular surface, occupying the anterior inferior portion—articulates with the sacrum. The posterior superior two-thirds, the tuberosity of the ilium, does not normally articulate with the sacrum. The bone here is roughened and connected to the sacral tuberosity by the posterior sacroiliac ligaments.

The sacroiliac joint is stated to be a diarthrosis capable of some minimal gliding and rotary movements. It may or may not possess a joint cavity with a synovial lining. Its nerve supply originates from the superior gluteal, the sacral plexus, and the posterior divisions of the first and second sacral nerves.

THE ACCESSORY SACROILIAC JOINTS

Various anatomists have described accessory sacroiliac joints. Most commonly these occur between the medial surface of the posterior superior iliac spine and the rudimentary transverse tuberosity just lateral to the second posterior sacral foramen. Normally the posterior superior iliac spine is 3 to 6 mm. from the posterior surface of the sacrum. When an accessory articulation is formed, the plane of the joint forms an angle with the plane of the normal sacroiliac articulation. By such an imperfect mechanical structure two bones articulate at two separate surfaces, the planes of which are angulated.

Less frequently an accessory articulation may develop between the tuberosity of the ilium and the sacral tuberosity, opposite the first posterior sacral foramen. At these points articular facets form. These are covered by hyalin or fibrocartilage and appear as true diarthroidial joints 1 or 2 cm. in diameter. A small foramen between this joint and the true sacroiliac articulation furnishes passage for nutrient blood vessels.

Trotter quotes the incidence of accessory sacroiliac joints as reported by different authors. The figure varied from 36 per cent in her own series of 958 pelves, down to that of Derry, 10.4 per cent in 192 skeletons.

Fifty-five innominate bones, some of them articulated, were studied in the Anatomy Department at Syracuse University Medical College. In 7 of this number there was evidence of accessory articulations. Four of the 7 accessory joints had become ankylosed. One must conclude, therefore, that the condition is not uncommon. Trotter, reviewing her 344 examples, found the incidence much higher in whites than in Negroes, greater in males than in females, and showing tendency to

[1] Accepted for publication in November 1949.

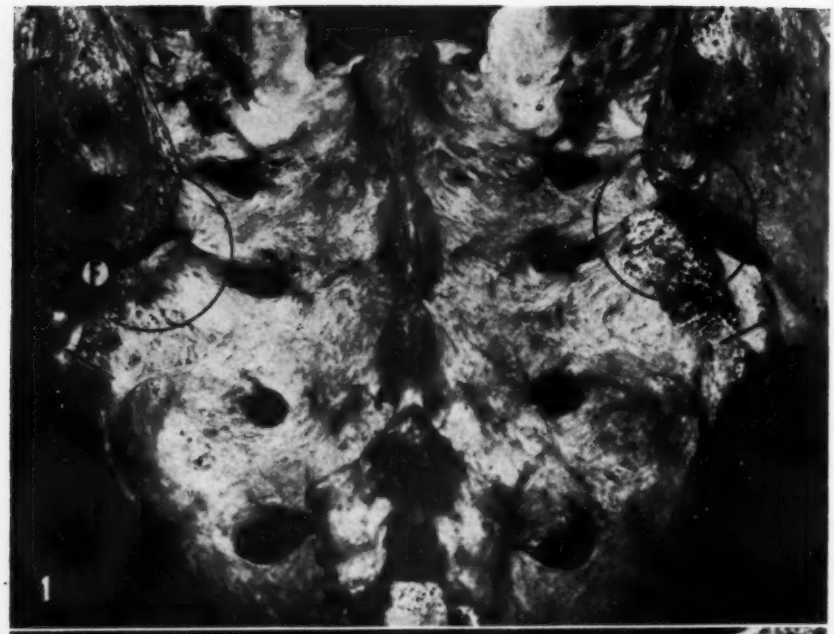

Fig. 1. Bilateral accessory sacroiliac joints in the circles. A part of the facet on the right side has been broken off. Note the sacral articular surfaces, especially on the left side. These occur lateral to the second posterior sacral foramina. Arrows indicate the normal sacroiliac joints. The foramen (F) between the normal and the accessory sacroiliac joint permits the passage of nutrient vessels.

Fig. 2. Specimen showing normal space between the left posterior superior iliac spine and posterior surface of the sacrum (X). On the right side (in circle) is shown an accessory sacroiliac joint, ankylosed by a chronic arthritic process. Arrows indicate the posterior margins of the auricular sacroiliac joints. These show some arthritic change.

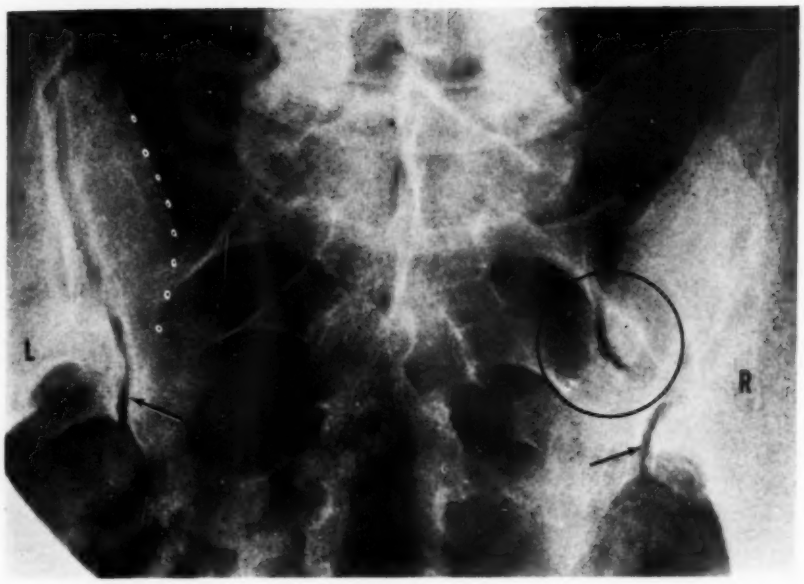

Fig. 3. Female, age 36. Low back pain and limitation of motion following automobile accident; tenderness to deep pressure over right sacroiliac region. The patient has an accessory sacroiliac joint on the right side (circle), possibly traumatized by the accident. The joint is retouched and a dotted line outlines the left posterior superior iliac spine. Arrows indicate the normal sacroiliac joints.

Fig. 4. Female, age 48. Low back pain since fall down stairs three months earlier. The patient indicated the sacrum as the site of discomfort. She has bilateral accessory sacroiliac joints (slightly accentuated, encircled). Arrows indicate the normal sacroiliac joints.

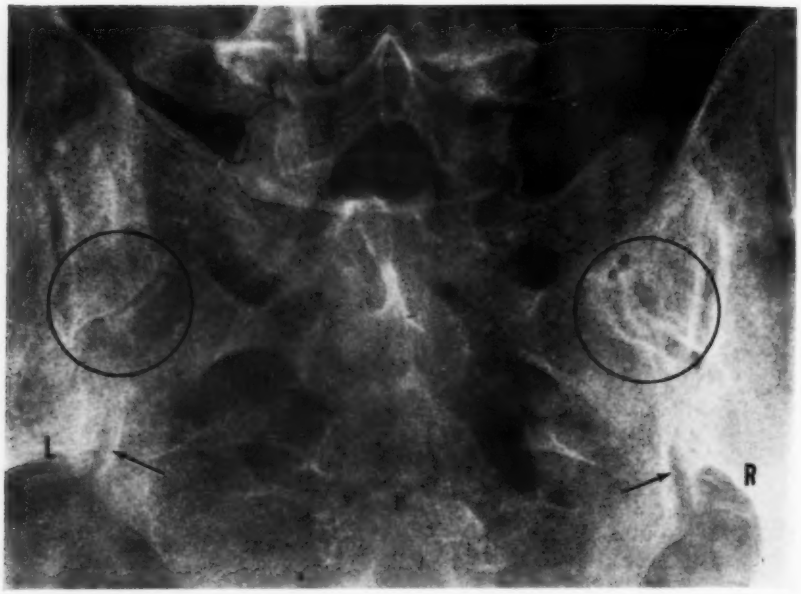

Fig. 5. Female, age 69. Right sciatic pain; absence of Achilles reflex; Dejerine's sign positive upon coughing. The lumbar curve is accentuated and persists upon anterior flexion. There is degeneration of the lumbar disks. Telescopic subluxation of the posterior joints has occurred as a result of the lumbar lordosis. Impingement at the tips of certain articular processes, secondary to this subluxation, has produced bony erosion beneath the pedicle at (S). There are bilateral accessory sacroiliac articulations (circles), but only the right one shows evidence of arthritic changes. This, however, is hardly responsible for the sciatica.

Fig. 6. Female, age 66. Pain in low back and left leg since jolting in automobile accident six months before. Tenderness to pressure over left posterior superior iliac spine. Film made with the patient supine shows an accessory sacroiliac joint on the left (circle). The right superior iliac spine is indicated by dots. Arrows, as in all the other illustrations, indicate the true sacroiliac joints. Note the foramen (inside edge of circle) between the left sclerosed arthritic accessory joint and the normal sacroiliac.

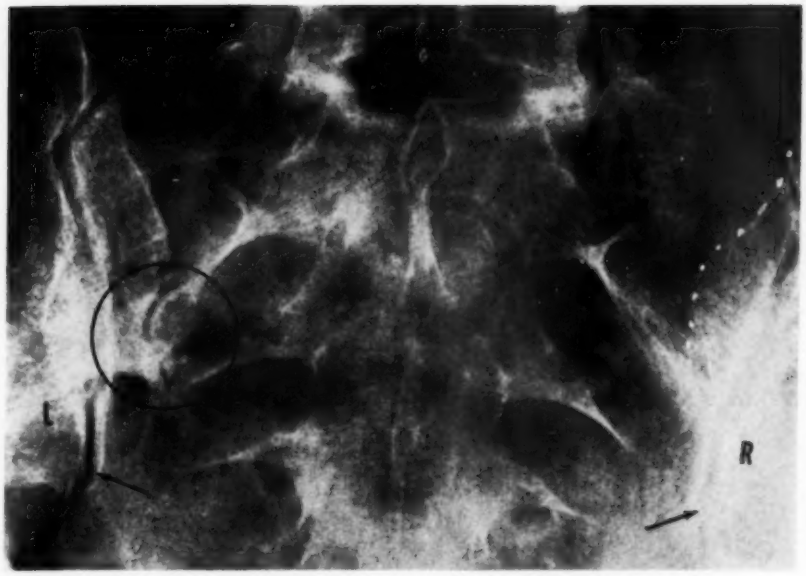

Fig. 7. Female, age 60. Pain in lower back and left sacroiliac region for five weeks; sudden onset when patient leaned over. Film made in prone position shows a unilateral arthritic accessory sacroiliac joint on the left side. Dotted lines indicate the normal right posterior superior iliac spine.

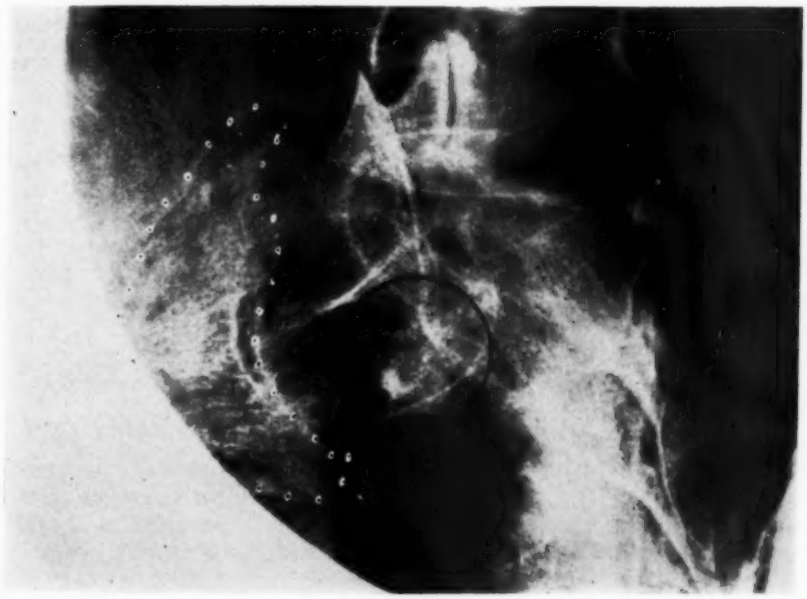

Fig. 8. Roentgenogram of patient shown in Fig. 7, 45° oblique projection, *en face* view (circle) of the accessory sacroiliac joint. Note the nutrient foramen between the two left sacroiliac joints both in Figs. 7 and 8. The dotted line outlines the auricular or normal sacroiliac articular surface (partly cut off).

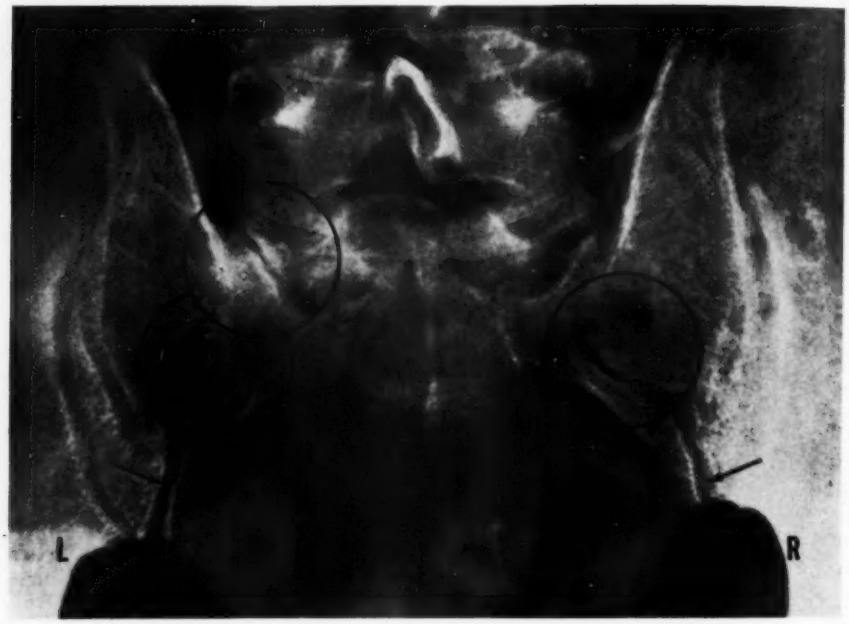

Fig. 9. Male, age 62. Low back pain for four months, extending down left leg to knee. No history of injury. Bending forward elicits pain in left sacroiliac region. Backward bending not painful. Straight leg raising to 80° from horizontal on the right side. The left leg can be raised only to 20°, whereupon the patient describes a painful "catch" in the left sacroiliac region. Prone film shows bilateral accessory joints between the posterior superior iliac spines and the sacrum (accentuated and encircled). A third accessory sacroiliac joint is seen above these on the left side, between the tuberosity of the ilium and the sacral tuberosity. This accessory joint shows advanced arthritic changes. Note the irregularity of the articular surfaces and the sclerosis of the underlying bony structures. Compare this with the other two accessory articulations (lower two circles), which do not show arthritic changes.

increase with advancing age. Giraudi believed the condition to be congenital.

Derry attributes the occurrence of these accessory articulations to the upright posture. As the human spine assumes the vertical position and the lumbar curve develops, the sacrum rotates on a transverse axis, its lower posterior portion becoming elevated. At the same time, there is a relative downward movement of the posterior iliac region, and the posterior superior iliac spines become more nearly approximated.

Giraudi illustrates one specimen having three accessory articulations on one side and two on the other. He believes the condition to be a cause of sacroiliac pain. Because of the nerve supply of these structures he feels that arthritis of these joints may be one cause of the "sacarthrogenetic telalgia" of Pitkin and Pheasant.

Trotter cites a patient complaining of pain in the region of the distribution of the superficial peroneal nerve. The posteroanterior roentgenogram showed an arthritic articulation between the right posterior superior iliac spine and the sacrum. In my own experience, this is not at all uncommon, although in many cases these joints are probably asymptomatic.

TECHNIC

Either the prone or the supine position may be used for a comparative visualization of the two sides of the sacrum. If one side is to be studied, in detail, however, the patient is placed in the supine position but rotated 45° toward the side to be examined. Stereoscopic studies are much preferred to single films. If an accessory joint is present, the articular facet will usually be seen projecting downward and

medially from the posterior superior iliac spine. If there is no arthritic process, a clean-cut articulation will be noted between this facet and the sacrum, just lateral to the second posterior sacral foramen.

In a substantial percentage of the cases visualized, there has been evidence of arthritic changes. These appear as thinning and irregularity of the joint space, bony exostoses of the joint margins, and sclerosis of the underlying bony structure. Most of these patients complain of low back pain, sciatica, and occasionally localized tenderness to deep pressure over the arthritic accessory articulation.

Rarely, one is able to visualize an arthritic process between the tuberosity of the ilium and the sacral tuberosity opposite the first posterior sacral foramen. The accessory articulations at this site are much more deeply placed than at the other. Arthritis involving these articulations was found to be compatible with low backache and pain upon attempted movement.

SUMMARY

Accessory sacroiliac articulations are frequently visualized between the ilium and the posterior surface of the sacrum. These joints may show arthritic changes of greater or lesser degree. Ankylosis may occur. Many of the patients complain of low back pain and some complain that pressure over the accessory joint is painful. Photographs of two sacra and radiographs of six patients showing accessory sacroiliac articulations are reproduced. These illustrate asymptomatic, arthritic, and ankylosed joints.

NOTE: I am indebted to Professor Philip B. Armstrong of the Anatomy Department of Syracuse University Medical College for the privilege of studying the anatomical specimens.

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SUMARIO

Articulaciones Sacroilíacas Accesorias con Alteraciones Artríticas

Con frecuencia se visualizan articulaciones sacroilíacas accesorias entre el hueso coxal y la cara posterior del sacro. Esas articulaciones pueden mostrar alteraciones artríticas de mayor o menor intensidad. Puede haber anquilosis. Muchos de los enfermos se quejan de dolor en la porción inferior del raquis y algunos de dolor al comprimir la articulación accesoria. Se reproducen fotografías de dos sacros y radiografías de seis enfermos con articulaciones sacroilíacas accesorias, ofreciendo ejemplos de articulaciones asintomáticas, artríticas y anquilosadas.

Pseudo-Cystic Shadows of the Right Pulmonary Base Due to Diaphragmatic Omental Hernia[1]

F. GARCÍA CAPURRO, M.D.,[2] and M. ARIAS BELLINI, M.D.[3]

THE NUMBER OF papers dealing with diaphragmatic hernia since the first studies of Ambroïse Paré in 1601 has gradually increased until this abnormality is today well known. The present authors have themselves contributed to the literature (1–5). There are, however, certain unusual hernias which deserve particular attention. Among these are herniations of the omentum, four examples of which are illustrated here. In such cases the shadow at the base of the right lung may be attributed to some other cause, leading to erroneous diagnosis and treatment.

Developmental errors involving the diaphragm and predisposing to hernia are of three types: (*a*) faulty relationship of the structures passing through the diaphragm (aorta, vena cava, and esophagus) to their corresponding orifices; (*b*) a defect in the diaphragmatic muscle fibers near the sternum, at the so-called foramen of Morgagni; (*c*) absence or atresia of the posterior segment of one or both hemidiaphragms due to underdevelopment of the pleuroperitoneal membranes. The resulting hernias are classified as true hernias or pseudohernias according as they have or have not a peritoneal sac. In one of the cases illustrated here this distinction was made by induction of a small pneumoperitoneum, which immediately produced a pneumothorax (Figs. 6 and 7).

The four hernias upon which this paper is based were of the type known variously as hernias of the foramen of Morgagni, hernias of Larrey's space, substernal or parasternal hernias, or, as Harrington (6) calls them, subcostosternal hernias.

The foramen of Morgagni is a triangular space with its vertex toward the central tendon of the diaphragm and its base in contact with the lateral border of the sternum. It is covered by pleura above and by peritoneum beneath. Though hernias through this space have long been known, having been mentioned by Morgagni as necropsy findings in 1769, they have been shown by Harrington to be the least common of the diaphragmatic hernias. In a series of hernia operations, he found but four involving Morgagni's foramen, and of this number only two were of the omental type.

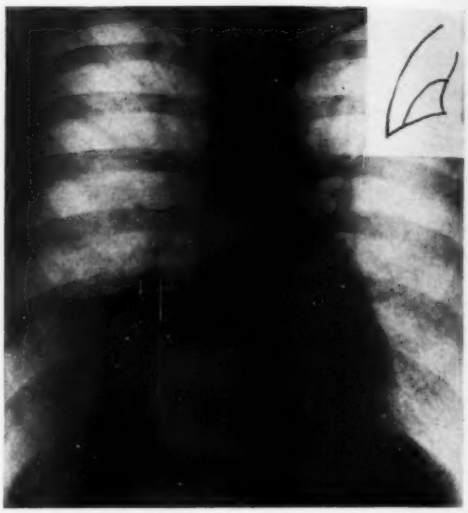

Fig. 1. Case A. Dense shadow in the right cardiophrenic angle, appearing as a semicircle with a clear upper outline gradually decreasing in density toward the outer margin.

Most often these hernias are discovered radiologically during examination for some other reason or incidentally in the course of a mass survey. Of 4 cases, 3 were discovered on fluoroscopy of the digestive tract and one in a mass survey. Roentgen examination is of the greatest importance for the diagnosis because of the paucity of

[1] Accepted for publication in January 1950.
[2] Adjunct Professor of Radiology, University of Montevideo.
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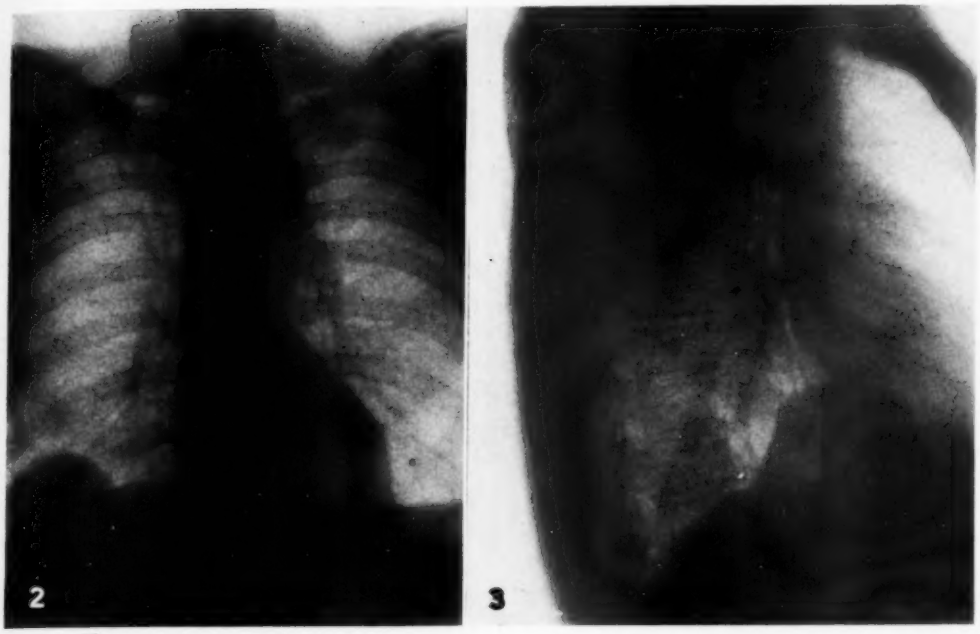


Figs. 2 and 3. Case B. At the base of the pathological shadow the outline of the diaphragm is interrupted, the two arcs forming a blunt angle. There is no evident elevation of the diaphragm.

symptoms and the difficulties of clinical examination of the region involved.

To avoid misinterpretation of the shadow in the roentgenogram, certain characteristic features must be kept in mind. In most instances the appearance is that of a mass of regular outline, similar to a cyst or other process in contact with the right diaphragm. Special points to be studied are as follows:

(*a*) The *dynamics of the diaphragm* are observed fluoroscopically, with special attention to deformities that may appear in deep inspiration and with Müller's and Hirtzenberger's tests. With these tests one may observe paradoxical elevations at the moment of descent of the diaphragm or immobility of the affected part.

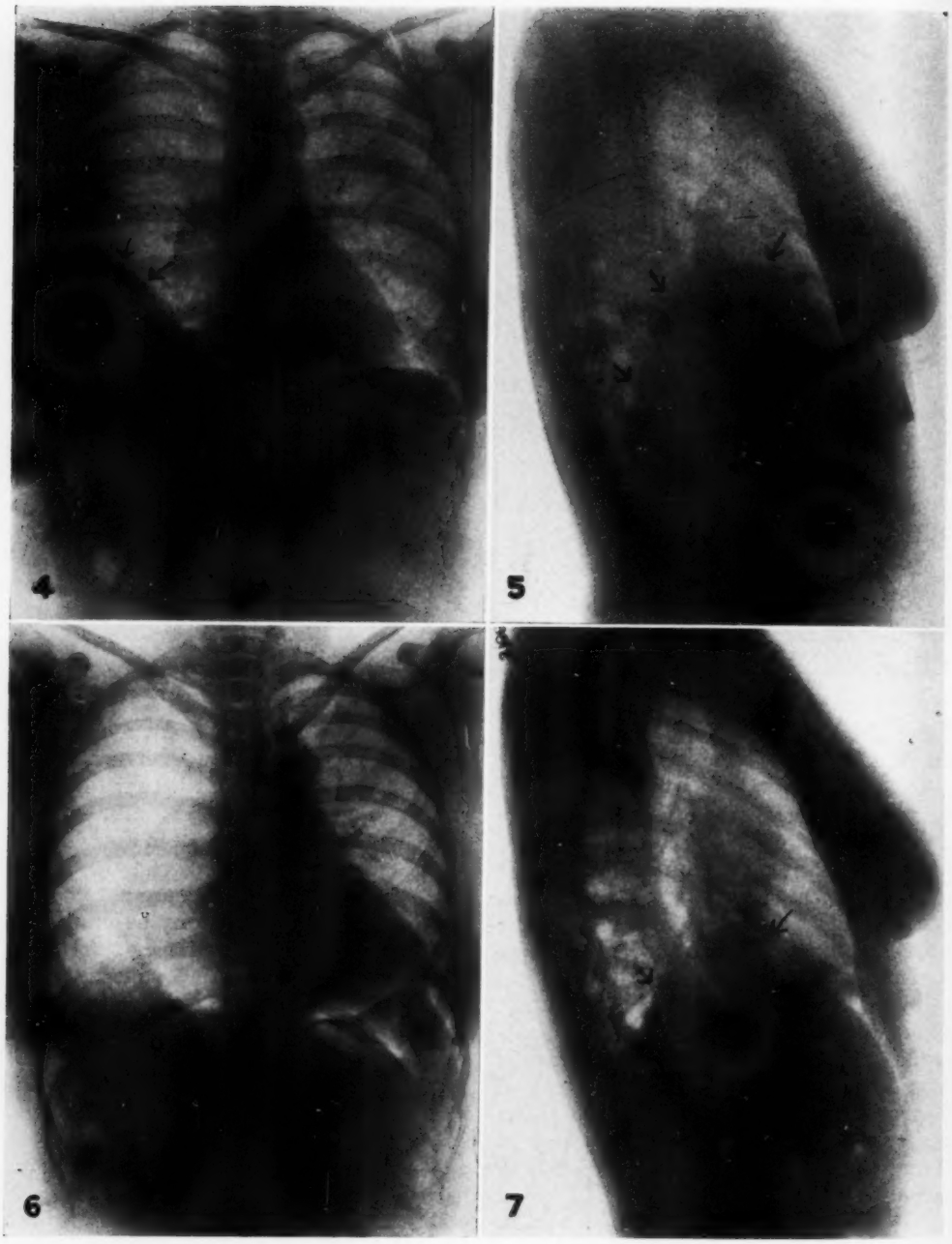
(*b*) The *exact spot where the shadow touches the diaphragm* is most important.

(*c*) The *character of the shadow and the contour of the diaphragm* are significant. The shadow is denser in the center, while the diaphragm is seen as two semicircles in both the anteroposterior and lateral view.

To complete the study, the colon, stomach, and duodenum must be examined. All three of these viscera seem to be attracted by the spot where the shadow appears, and in some instances the shadow of the right colon is insinuated at the lower profile of the diaphragm (Figs. 8, 10, 11).

If the foregoing findings are not conclusive, pneumoperitoneum may be employed, as suggested in previous papers. This we believe to be the only method permitting a conclusive diagnosis. If the hernia is a true one, air will accumulate around the pathological shadow; if it is a pseudohernia, without a peritoneal sac, a pneumothorax will develop.

In our cases the roentgenograms showed a shadow on the right hemidiaphragm, forming a semicircle on top of the highest segment (Figs. 1 and 9). This shadow was limited below by an interruption in the outline of the diaphragm (Figs. 2, 3, 9), which has the appearance of being formed by the junction of two arcs, one on either side of the dense shadow. These arcs were demonstrable in both anteroposterior and lateral projections.



Figs. 4–7. Case C. In Fig. 4 the shadow of the right pulmonary base might be erroneously interpreted as a subphrenic process. In Fig. 5 the diaphragm is seen in its normal position. Figs. 6 and 7 were obtained after induction of a diagnostic pneumoperitoneum, with simultaneous pneumothorax. The diaphragm is in normal position, showing the typical interruption that transforms its outline into two arcs.

Fig. 8. Case C. The stomach, especially the antropyloric portion, is moved to the right and elevated, approaching the diaphragmatic hiatus.

Fig. 9. Case D. Dense shadow in the right cardiophrenic angle.

Figs. 10 and 11. Case D. Elevation of the transverse colon, which forms an angle that is seen in the lateral view insinuated into the peritoneal space between the liver and the diaphragm. (Courtesy of Dr. Añanos, Rosario.)

SUMMARY

Among diaphragmatic hernias, those through the foramen of Morgagni are least common. In this group are the omental hernias, 4 cases of which are illustrated.

On the roentgenogram these hernias may be mistaken for cysts or other pathological processes of the right lung or for liver cysts. To avoid misinterpretation of the roentgen picture, the following characteristic features should be borne in mind.

(*a*) A dense shadow forming a semicircle in contact with the diaphragm at a point where the latter seems to be interrupted, forming two lateral arcs.

(*b*) Immobility of the diaphragm, with a possible paradoxical movement of the shadow.

(*c*) Displacement of the duodenum to the upper right abdomen and insinuation of the colon near the pathological shadow.

Diagnostic pneumoperitoneum makes possible a definite diagnosis.

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SUMARIO

Sombras Seudoquísticas de la Base del Pulmón Derecho Debidas a Hernia Epiploica Diafragmática

Entre las hernias diafragmáticas, las que atraviesan el agujero de Morgagni son las menos frecuentes, correspondiendo a este grupo las epiploicas. Preséntanse aquí 4 casos de esta forma extraña.

En la radiografía, pueden confundirse estas hernias con quistes u otros procesos patológicos del pulmón derecho o con quistes hepáticos. A fin de evitar errores en la interpretación del cuadro roentgenológico, hay que tener presentes las siguientes características.

(*a*) Sombra espesa formando un semicírculo en contacto con el diafragma en un punto en que el último parece hallarse interrumpido, formando dos arcos laterales.

(*b*) Inmovilidad del diafragma, con un posible movimiento paradójico de la sombra.

(*c*) Desplazamiento del duodeno a la porción superior derecha del abdomen y deslizamiento del colon cerca de la sombra patológica.

El neumoperitoneo diagnóstico permite hacer un diagnóstico bien definido. Si la hernia es real, el aire se acumula alrededor de la sombra patológica; si es falsa, sobrevendrá un neumotórax.

Congenital Defect in the Diaphragm

A Case Report[1]

FRED H. DECKER, M.D.[2] and JAMES C. FASH, M.D.[3]

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CONGENITAL defects in the diaphragm have been described with greatly increasing frequency in recent years probably as a result of more general use of roentgenologic procedures, which are the most reliable and usually the only certain method of establishing the diagnosis.

Arey (1) states that the diaphragm is derived from four sources: (*a*) the septum transversum, which forms the ventral portion; (*b*) the pleuroperitoneal membrane, which gives rise to the lateral portion; (*c*) the dorsal mesentery, from which comes the median dorsal portion; (*d*) derivatives from the body wall. The striated muscle is derived from muscle masses lying originally opposite the fifth cervical segment, seen first in the 9-mm. embryo. These are thought to migrate caudally with the septum transversum.

A simple and useful classification of congenital diaphragmatic hernias is that proposed by Philip Thorek (2):

1. Those in the posterolateral portions, along the embryonic pleuroperitoneal canal (foramen of Bochdalek).
2. Those in the retrosternal area (foramen of Morgagni).
3. Those through the esophageal hiatus.

Classifications proposed by others are similar. They contain, also, references to hernias through miscellaneous congenital defects and include reports of cases in which a large portion—sometimes all—of one hemidiaphragm was absent (3–5).

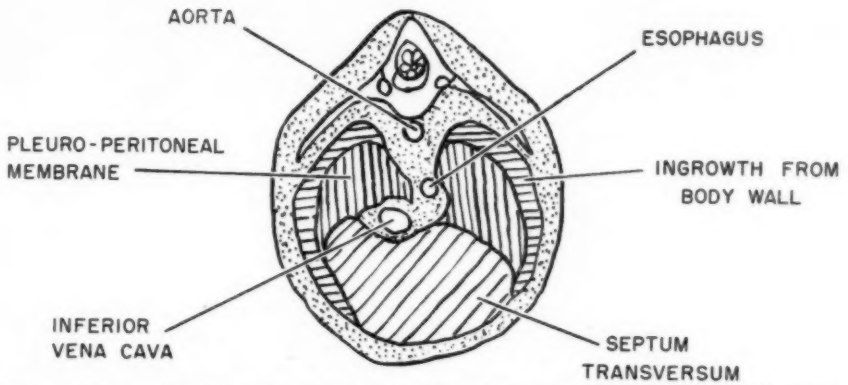

Fig. 1. Diagram identifying the several contributions to the definitive diaphragm (Patten after Broman). From Arey's *Developmental Anatomy*, W. B. Saunders Co., Philadelphia.

Kirklin (6) makes the statement that hernias through the esophageal hiatus constitute 98 per cent of all diaphragmatic hernias. They had been found in more than 1 per cent of all roentgen examinations of the stomach at the Mayo Clinic.

Harrington (7) reports a series of 430 cases of diaphragmatic hernia in which operation was performed. Of these, 343 were of the esophageal hiatus type, 9 were through the pleuroperitoneal hiatus, 12 consisted of absence of the posterior fourth of the left diaphragm, 8 were through the

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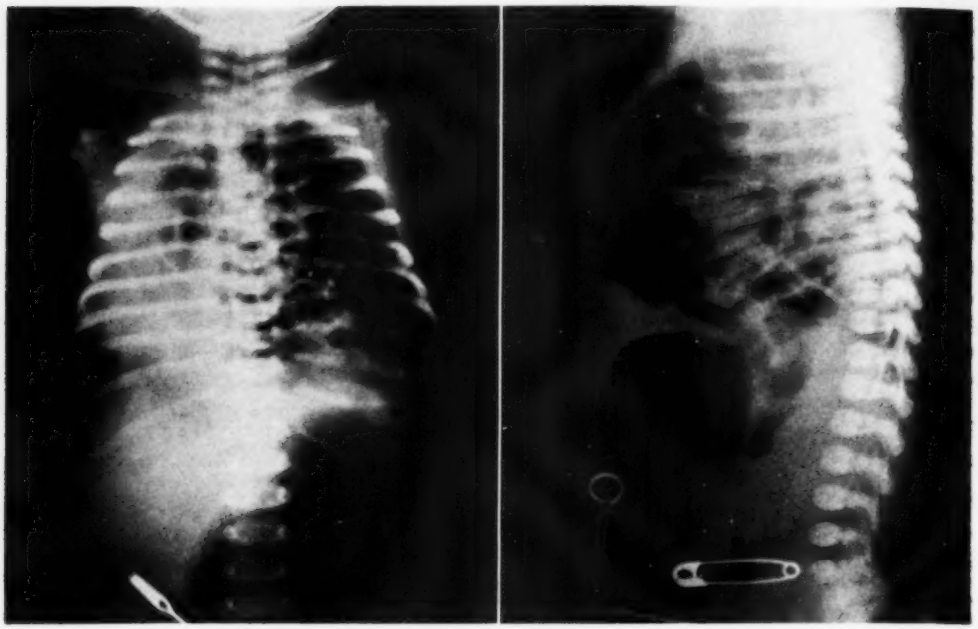

Fig. 2. Postero-anterior and lateral views of the chest and abdomen.

foramen of Morgagni, and the other 58 were traumatic. All but one of the latter group involved the left diaphragm.

A persistent dorsal opening, such as occurred in the case to be reported here, is explained by imperfect development of the pleuroperitoneal membrane. It differs from the type caused by a local muscular deficiency in the absence of a sac.

Harrington (8) agrees in essence with Arey's embryological discussion. He suggests that the greater frequency of left-sided defects is due to the fact that the right diaphragm is protected by the liver, and its early development is thus facilitated. The descent of the stomach seems important in the development of esophageal hiatus hernias but is probably not relevant in other diaphragmatic defects.

DIAGNOSIS AND TREATMENT

Dyspnea, cyanosis, and general physical distress, occurring together in a newborn infant, sometimes accompanied by vomiting, are suggestive of diaphragmatic defects, with the presence of abdominal viscera in the thorax. Physical examination is further confirmatory, and fluoroscopy and roentgenograms are diagnostic. Kirklin and Hodgson (9) have described the roentgen findings in the various types of diaphragmatic hernia.

Surgical repair of these defects is quite successful and should be done early. Cases are reported in which repair was done on babies only a few days old, as well as on those who had survived for several months or years.

In view of the success to be expected with modern methods of treatment, it is apparent that all who are concerned in the care of the newborn should be mindful of this condition. This would seem to be especially true of the roentgenologist with whom the final diagnosis rests.

CASE REPORT

A full-term male infant born the previous evening at another institution was brought to the X-ray Department of the Methodist Hospital (Peoria) on the morning of Feb. 19, 1949, as an outpatient. There was nothing remarkable about the delivery or family history which we could discover. The

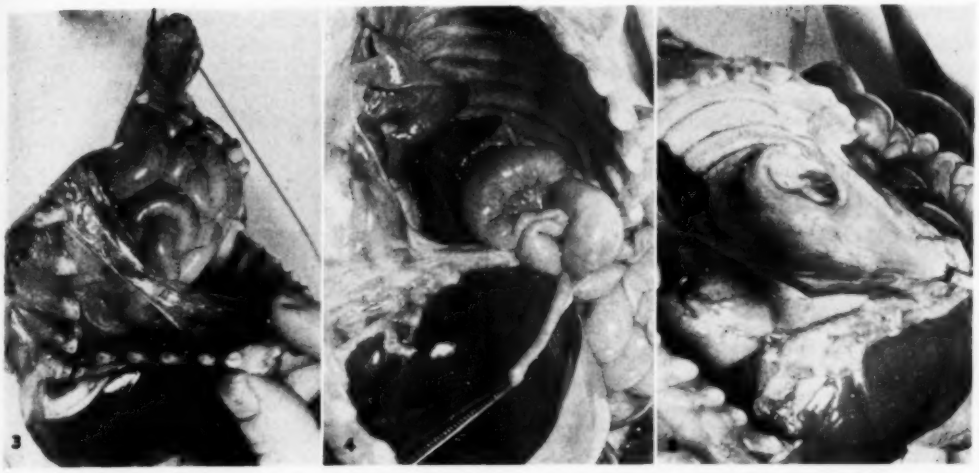

Fig. 3. The breast plate has been reflected downward at autopsy, showing the viscera in the thoracic cavity.
Fig. 4. Left thoracic cavity, with part of the viscera removed, demonstrating cecum and appendix above the diaphragm. Collapsed left lung is adjacent to the mediastinum.
Fig. 5 Diaphragm from above, showing defect.

mother was normal. The identity and condition of the father were unknown.

The child did not cry well at birth and had steadily become more dyspneic and cyanotic. Oxygen had been given continuously and was still being administered. Respirations were rapid and shallow, cyanosis was pronounced, and the baby was listless. He appeared well formed, of average size, and somewhat fat.

Films of the thorax and abdomen showed the left hemithorax entirely filled by what appeared to be loops of gas-filled intestine. This configuration was also obtained in a small portion of the right hemithorax opposite the second to sixth ribs posteriorly and medially. The heart and mediastinal shadows were displaced to the right, and there lost in a homogeneous shadow of increased density which occupied all of this half of the thorax except the portion mentioned above, and a small area laterally near the seventh rib, which appeared to contain more or less normal lung markings. The abdomen showed almost solid homogeneous density except for a large gas bubble in the stomach and a loop of small bowel which appeared to extend directly from this to a point laterally on the left, where it joined the intestinal shadows in the thorax.

Fluoroscopy confirmed these findings. The baby died while preparations were being made to give barium by mouth in an attempt to gain further information.

The diagnosis on the basis of the roentgen examination was: "Herniation of small bowel into the left and right lung fields, apparently displacing the mediastinum to the right, with almost complete collapse of the right lung."

Autopsy, by Dr. D. O. Manshardt, disclosed a large defect posterolaterally in the left diaphragm, measuring about 2 × 3 cm. In the left hemithorax was found all of the intestinal tract from the duodenum to the mid-transverse colon, as well as the spleen, the pancreas, and the collapsed left lung. There was no herniation through the mediastinum; the bowel which appeared in the films to be on the right of this structure had pushed the mediastinum over until it was far to the right of the mid-line. In the right hemithorax was the right lung, collapsed except for a small portion, anterior and lateral, in the middle lobe.

No other congenital anomalies were found.

We postulate that a considerable but unknown part of the bowel, and possibly the spleen and pancreas, was in the left pleural cavity during the infant's later intra-uterine life. These were, of course, collapsed and devoid of gaseous contents until after birth. It is well known that soon after parturition, the infant starts to swallow air, causing gaseous distention of the bowel, which persist at least until the child is two or three years of age. Films of young children constantly demonstrate this. It is our opinion that this gradual filling of the bowel with gas during the first few hours of life caused the progressive dyspnea, tachypnea, and cyanosis by gradual collapse of aerated lung tissue, of which there was probably a very small amount at any time. We further suggest that

death was caused by a combination of anoxia, so produced, together with cardiac embarrassment by the anoxia and mechanical pressure exerted by the distended bowel. A similar, though not identical, idea has been advanced by at least one other observer (10).

SUMMARY

1. The embryology, classification, etiology, diagnosis and treatment of congenital diaphragmatic defects are briefly reviewed.

2. A case in a newborn infant is reported, with autopsy findings.

3. Suggestions are advanced regarding the physiology and mechanics of the bowel and lungs in this condition.

4. The importance of early and accurate diagnosis, with particular reference to the roentgenological aspects, is stressed.

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SUMARIO

Deformación Congénita del Diafragma: Historia Clínica

El caso comunicado es de hernia a través de una brecha congénita en el diafragma de un recién nacido. En la autopsia se encontraron en el hemitórax izquierdo el tubo intestinal desde el duodeno hasta el colon mesotransverso, el bazo y el páncreas. El mediastino había sido empujado muy a la derecha de la línea media y el pulmón izquierdo estaba aplastado.

Presupónese que una parte considerable del intestino y posiblemente el bazo y el páncreas se hallaban en la cavidad pleural izquierda hacia el final de la vida intrauterina y que, a medida que el intestino se llenaba gradualmente de gas en las primeras horas de vida, se aplastó el tejido pulmonar aireado. La muerte fué imputada a una combinación de anoxia y desfallecimiento cardíaco debido en parte a la anoxia y en parte a la presión mecánica ejercida por el distendido intestino.

Recálcase la importancia del diagnóstico temprano de dichos casos, con referencia particular a las fases roentgenológicas.

Calcified Gastric Leiomyoma[1]

Report of a Case

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Emory University, Ga.

THE PURPOSE OF this communication is to present a case of large leiomyoma of the stomach containing extensive calcium deposits easily visible on the roentgenogram.

Mention has been made (1, 3, 4) of the frequent occurrence of microscopic calcification in leiomyomata of the stomach, particularly in the central portions of the mass, and it would seem that more of these tumors should produce calcium sufficient for roentgenographic visualization. Actually, however, grossly calcified gastric leiomyomata are exceedingly rare. A review of more than fifty articles on smooth-muscle tumors of the stomach revealed a single case similar to the one to be recorded here, that of Heitz (2), reported in 1902. His description (in part) follows:

"The tumor lies in the posterior wall .... It is adjacent to the middle of the lesser curvature and it raises up the serosa over the posterior side of the lesser curvature behind the gastro-hepatic ligament in the lesser peritoneal sac. It produced no elevation into the interior of the stomach, and the mucous membrane is normal over it. The tumor was the size of a nut, very hard, giving a clear sound to percussion. Sectioned through its middle, it was found to be formed entirely of a calcareous substance covered by a thin serosal membrane. In the posterior part, however, the calcareous granulations were not confluent and were simply disseminated in a hard, apparently fibrous tissue. A small piece from this part was decalcified with picric acid and embedded in paraffin for the histologic examination. The sections show here and there small calcium masses strongly colored by hematoxylin. The framework of the tumor is formed by abundant and close-packed connective tissue with rare blood vessels. At certain points, smooth muscle cells can be recognized with their elongated nuclei, but fibrous tissue predominates. In résumé, the tumor is fibrous, secondarily calcified, and grew at the expense of the smooth muscle tissue in the tunica muscularis of the stomach."

The size, the degree of cytoplasmic degeneration, and the extent of calcification of the tumor in our patient indicate that it had been in existence for a long time, an assumption which Heitz made in his case.

CASE REPORT

A. B. C., aged 58, a British West Indian Negro employed as a post-office printer, was admitted to Presbyterian Hospital (New York) on June 19, 1947, complaining of nausea, vomiting, weakness, and low-grade fever.

Present Illness: The patient had been in good health until one month earlier, when he experienced a "falling off" of appetite, which increased progressively and was associated with a 15-pound weight loss. Three weeks before admission he had received an injection of influenza-pneumococcus vaccine (0.5 c.c.) for "sinus trouble." This was followed shortly by transient nausea, mild malaise, chilly sensation, sweating, and a rise of temperature to 102°. Six days before admission, a similar injection produced malaise, chilly sensation, extreme weakness, and fatigue. Four days before admission the patient began to vomit all food ingested, speech became incoherent, and the gait unsteady. All symptoms persisted to the time of admission.

The patient had received codeine, aspirin, and citrocarbonate from his physician. The taking of citrocarbonate was followed by crampy abdominal pains and several watery stools. For two weeks prior to admission, there had been heavy bifrontal headaches, with occasional blurring of vision.

Past History: There was a history of typhoid in childhood and of syphilis at the age of twenty-five, which had been treated. At the age of thirty-five, the patient worked as a "lead-stone handler" and was exposed to lead poisoning, but quit this job on the advise of his physician.

Physical Findings: The temperature was 101.4°, pulse 100, respirations 14, blood pressure 150/100. The conjunctivae were injected. Auscultation of the heart revealed a soft apical systolic murmur. The abdomen was protuberant, but there were no palpable masses. There was a right hydrocele. The prostate was small. The lower extremity reflexes were normal.

[1] From the Department of Radiology of the College of Physicians and Surgeons, Columbia University, and the Radiological Service of the Presbyterian Hospital, New York. Accepted for publication in September 1949.

Fig. 1. Abdominal film showing the area of irregular calcification in the left upper quadrant.

Laboratory Data: An admission blood count showed hemoglobin 12.5 gm., red blood cells 3.5 million, white blood cells, 7,280, with 90 per cent polymorphonuclears, 2 per cent monocytes, 8 per cent lymphocytes, no eosinophils, no basophils. The sedimentation rate was 15 mm. in one hour.

The stools were tan-colored and the guaiac test was negative on admission. The test was repeated on the fourth hospital day with a finding of 2+ but was again negative on the eighth day. No parasites were found. A lumbar puncture revealed nothing of significance.

Blood chemistry values were as follows: Second day: plasma carbon dioxide combining power 94.2 volumes per cent; plasma chlorides 557 mg. per cent; urea nitrogen 84 mg. per cent; fasting sugar 106 mg. per cent. Thirteenth hospital day: serum phosphatase 6.9 Bodansky units; urea 61 mg. per cent; bilirubin 0.3 mg. per cent; cholesterol 35 mg. per cent; protein 6.9 gm. per cent; albumin 3.7 gm. per cent; globulin 3.2 gm. per cent; euglobulin 0.7 gm. per cent.

Lead determinations on the blood showed 0.13 mg. per 100 gm., and on the urine 0.012 mg. per 1,000 c.c.. The cephalin flocculation test for liver function was negative.

Roentgen Studies: An anteroposterior abdominal film, on June 26, revealed a large area of irregular

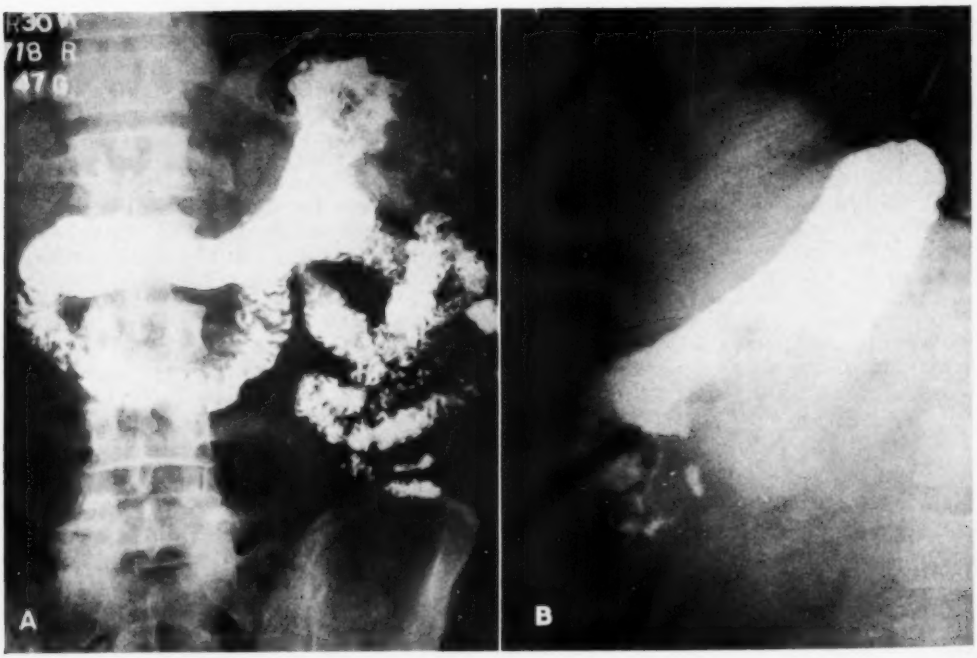

Fig. 2. A. Frontal horizontal view of the barium-filled stomach. The greater curvature is irregular adjacent to the calcified area. The margin of the lesion is sharply defined inferiorly by the defect in the curvature and by the calcium in the periphery of the tumor.

B. Lateral horizontal view of the barium-filled stomach. The tumor produces a large defect in the posterior wall of the stomach. The superior and inferior margins of the tumor are sharply defined.

opacities in the left upper quadrant (Fig. 1). The nature of these opacities could not be determined, but calcification of the spleen and retained barium in the gastro-intestinal tract were suggested as possibilities. On July 2 a barium enema study was done, indicating that the mass lay outside the colon and apparently was not a part of it. Examination of the stomach on July 7 showed the calcium shadows to lie partly within and partly without the left lateral and posterior gastric wall in its upper portion (Fig. 2). The stomach was partially obstructed by the mass.

Fig. 3. Photograph of the excised tumor and stomach. The tumor has been opened, and its cut surfaces face the camera.

Course: On July 8, a surgical consultation was ordered, and exploration was advised. The surgeon's impression was "neoplasm of the stomach (probably inoperable)." On July 16, a partial gastrectomy was performed by Dr. Parsons and Dr. Carroll. The operative report described "a globular mass about 10 cm. in diameter arising from the greater curvature to about opposite the incisura. This was partly intra- and partly extra-gastric. No enlarged lymph nodes were seen. No metastases were noted."

Pathological Report: The pathologist's report described the specimen as consisting of two separate parts. One, apparently greater omentum, measured 30 × 15 cm., and contained one lymph node, 4 × 5 mm., in its upper margin. The remainder of the omentum was grossly normal.

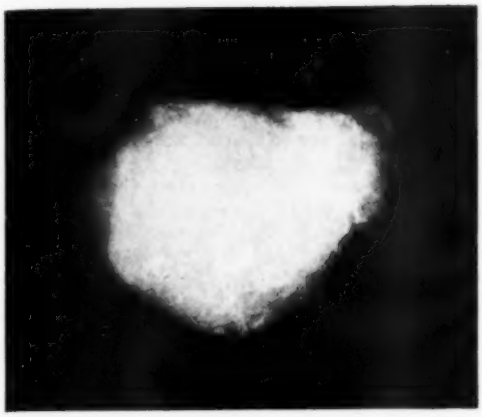

Fig. 4. Roentgenogram of the excised tumor, showing the gross calcifications in the mass.

The second part consisted of the stomach, previously opened along a line a little anterior to the greater curvature (Fig. 3). Occupying the major portion of the fundus was a firm mass, 8.5 × 7.5 × 6.0 cm., apparently intramural, with questionable penetration at the left lateral greater curvature. This when sectioned was found to be diffusely calcified (Fig. 4). It contained one 3-mm. cyst, was partly striated, and also showed a few gelatinous areas. On palpation, the cut surface was firm, and multiple calcified spicules could be felt. The color was grayish-pink. The mucous membrane was attached to the lateral half of the tumor and it was in the central part of this attachment that the tumor seemed to have penetrated through the wall of the stomach and possibly into the omentum on its lateral margin.

The microscopic description was as follows: "Section of the tumor shows fragments of calcification scattered throughout a stroma made up of whorled convolutions of fibrous tissue which, after decalcification in the laboratory, shows many empty small spaces, probably due to cystoplasmic degeneration. There appears to be a fibrous capsule along the border of the tumor and hence no external penetration is apparent in this section. There are definite evidences of small muscle degeneration, as indicated by calcification, fibrous tissue replacement, and vacuolization.

"Additional sections show considerable mucous membrane damage and the same tumor as described above. There is chronic inflammation in the thinned mucosa, and signs of pressure atrophy. The submucosa is edematous.

"No metastatic disease was found in the lymph nodes."

The histopathological diagnosis was leiomyoma.

Following operation, the patient was returned to the ward in poor condition. In spite of supportive therapy (oxygen, transfusions), he died twenty-four hours postoperatively.

Autopsy failed to disclose any structural alteration that could be correlated with the mental symptoms displayed on admission. An interesting incidental lesion was early myelofibrosis, with extramedullary foci of hematopoiesis in the liver. Presumably death resulted from postoperative shock. As is usually the case, the leiomyoma was confined to the primary site.

SUMMARY

A case of large gastric leiomyoma containing gross calcium deposits demonstrable on x-ray examination of the abdomen is reported.

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SUMARIO

Leyomioma Gástrico Calcificado. Observación

El caso descrito es de leyomioma del estómago conteniendo depósitos macroscópicos de calcio descubiertos roentgenográficamente y comprobados en la autopsia. Es sabido que la calcificación microscópica no tiene nada de extraño en los leyomiomas gástricos, pero entre más de 50 trabajos relativos a los tumores del músculo liso del estómago sólo se encontró un caso semejante al comunicado ahora.

Pirie's Bone[1]

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THERE is a general misconception regarding the significance of a small accessory ossicle located on the dorsum of the astragalus, just proximal to the astragaloscaphoid joint. A roentgenogram taken following a traumatic incident about the ankle joint will reveal this ossicle, at times with a somewhat irregular surface, adjacent to the main body of the astragalus. This repeatedly occurs in compensation cases with a misdiagnosis of a chip fracture.

A. H. Pirie, in 1921, first focused attention on this ossicle, which now bears his name. At that time he had collected 14 cases, in 4 of which the condition was bilateral. Proof of the existence of the bone was obtained postmortem.

Notwithstanding Pirie's report, there has been a paucity of comment on the condition in the medical literature, and it is usually omitted from standard textbooks, being mentioned only in Ferguson's text.

Figs. 1 and 2. Two examples of Pirie's bone on the dorsum of the neck of the astragalus. Note the irregularities of the surface, often present.

The distal end of the astragalus often exhibits developmental irregularities. The astragaloscaphoid ossicle is a frequent occurrence and causes no difficulties. The irregularity in contour in the form of an exostosis on the dorsum of the neck, called the astragaloid spur, is less well known. At times this spur may be present as a dis-

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[1] From the Department of Radiology, New York University-Bellevue Medical Center, New York, N. Y. Accepted for publication in November 1949.

tinct ossicle, with cortex on each surface, and no demonstrable defect in the astragalus, in spite of the irregularity in appearance periodically observed on the surface adjacent to the main body of the tarsus. It has been shown that pathologically the line of demarcation from the talus is cartilage.

This pitfall in diagnosis can often be avoided by taking the opposite ankle for comparison, since there is a distinct bilateral tendency. The fact that no essential change is demonstrable in the roentgenogram, after the repeated application of a cast for varying lengths of time, should definitely establish the diagnosis of an accessory ossicle in contradistinction to a chip fracture.

SUMMARY

Attention is again focused on an accessory ossicle, called Pirie's bone, located on the dorsum of the astragalus. When demonstrated roentgenographically following trauma, it may be mistaken for a chip fracture. Its bilateral tendency helps in the correct diagnosis.

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SUMARIO

El Hueso de Pirie

Llámase la atención sobre un osículo accesorio, denominado hueso de Pirie, y situado en el dorso del astrágalo, que con frecuencia se confunde con una esquirla. La tendencia bilateral que muestra ayuda a establecer el diagnóstico acertado.

EDITORIAL

An Invitation

The Thirty-sixth Annual Meeting of the Radiological Society of North America will be held in Chicago, at the Palmer House, from December 10th through the 15th.

You are invited to this 1950 meeting, and we of Chicago will be pleased to have the opportunity of welcoming you to our fair city.

The many advantages of a meeting here are well known to all of you. We are centrally located. We have outstanding transportation facilities, by train, by air, by bus, and by automobile. The Palmer House is ideally set up for housing, for technical and scientific exhibits, and for scientific sessions and refresher courses, all under the one roof.

A well rounded, diversified program has been planned for your Annual Meeting, beginning with Refresher Courses Sunday afternoon and evening and continuing daily from 8:30 to 10 A.M. throughout the meeting (see pages 426–433). This interesting part of our program continues to be a most popular feature of our annual session and this year will not be an exception. The Scientific Sessions will all be held in the ballroom, eliminating the unavoidable, yet sometimes disconcerting, conflicts so often encountered when diagnostic and therapeutic programs are presented simultaneously in different rooms.

The opening program on Monday morning, "A Discussion of Economic Problems," should be of interest to all medical men. Wednesday of the meeting has been designated as "Chicago Day", the program for this day will be presented by local radiologists and their medical colleagues in other specialty fields. It is hoped that this effort will stimulate other medical centers to present similar programs at future meetings of the Society.

The Scientific and Technical Exhibits, the backbone of all good meetings, have been well planned and should be well attended by all, especially so since time breaks for such attendance have been provided between Refresher Courses and Scientific Sessions.

The Annual Carman Lecture, a regular outstanding feature of our meeting, will be given Tuesday evening. Doctor Wendell G. Scott, of St. Louis, one of America's leading radiologists, will be the lecturer, and his subject will be "The Development of Cardiovascular Radiology."

The visiting ladies will be kept busy with the program being arranged by the Local Ladies Committee.

Business sessions of the Society will be held Monday, Tuesday, and Thursday afternoons. Time has been set aside for these meetings to give ample opportunity to conduct the important and serious business of the Society without interfering with the rest of the Program.

The Annual Banquet will be held Thursday evening. As usual, this event should provide a good opportunity for that social relaxation so necessary to those participating in a serious scientific assembly.

The meeting will close Friday, with a Scientific Session that will run from 10:30 A.M. to 1 P.M.

This résumé of scheduled activities is presented as a Greeting from your officers and as an official invitation to you to attend this, the Thirty-sixth Annual Meeting of your Society.

Be seeing you in Chicago, in December.

WARREN W. FUREY, M.D.
President

REFRESHER COURSES: POST-GRADUATE INSTRUCTION

The 1950 refresher course series will be presented at the Thirty-sixth Annual Meeting of the Radiological Society of North America, at the Palmer House, Chicago, Ill. The courses open with "Therapy Information" at 3 P.M., Sunday, Dec. 10, followed by Film-Reading at 7 P.M.

Commencing Monday, Dec. 11, there will be seven courses daily from 8:30 to 10 A.M. No other meetings will be scheduled during these hours and, so far as possible, the courses are arranged so that those interested in a particular subject may enroll in a related series.

Admission to the courses will be by ticket only.

Non-members will be charged $3.00 for each course up to a maximum of $10.00 for the series. No charge will be made to reserve officers still on active duty and residents and fellows in radiology

Read the description of the courses, noting particularly the days upon which they are offered, and make your selection for each day. State your first, second, and third preferences, as in some instances the number attending each course must be limited by the seating capacity of the rooms.

If your application is received prior to Dec. 5, your tickets will be mailed to you. Later than that they will be held at the Registration Desk in the Palmer House. If the courses are not filled by the time of the meeting, the remaining tickets will be available at the Registration Desk.

It may be necessary to revise some courses or to change some instructors. We shall, however, adhere as closely as possible to the printed program.

Course No. 1: Sunday, 3–5 P.M.

Therapy Information

JAMES W. J. CARPENDER, M.D.
ANNA HAMANN, M.D.
IRVING HUMMON, M.D.
HERBERT SCHMIDT, M.D.
DANLEY P. SLAUGHTER, M.D.
ERIC UHLMANN, M.D.
T. J. WACHOWSKI, M.D., Moderator

This panel will endeavor to answer questions on indications and technics of radiotherapy. Questions will be accepted from the floor but preferably should be sent in advance to the moderator, T. J. Wachowski, M.D., 310 Ellis Ave., Wheaton, Ill.

Course No. 2: Sunday, 7–9 P.M.

Film-Reading Session

EARL E. BARTH, M.D.
EARL R. MILLER, M.D.
EDWARD B. D. NEUHÄUSER, M.D.
LAURENCE L. ROBBINS, M.D.
LEO G. RIGLER, M.D., Moderator

This period is designed to present a diagnostic clinic and demonstration of the methods of examination in selected cases. The cases will be chosen by the Chicago Roentgen Ray Society, but any member who desires to present an instructive case may write to Dr. Leo G. Rigler, University of Minnesota Medical School, Minneapolis 14, Minn., or Dr. Earl E. Barth, 303 East Chicago Ave., Chicago, Ill.

Course No. 3: Monday, 8:30–10:00 A.M.

Dental Roentgenology

S. A. LOVESTEDT, D.D.S.
Mayo Clinic, Rochester, Minn.

The refresher course on dental roentgenology will consist of two parts: the first to cover local conditions of the teeth and related structures; the second to present the intra-oral roentgenographic evidence of systemic disease.

The first part will include a discussion of (1) anatomic landmarks of the jaws, (2) some of the more commonly occurring congenital and developmental dental anomalies, (3) dental pathologic conditions which are seen roentgenographically, and (4) cysts of dental and non-dental origin.

The second part of the course will be devoted to the intra-oral roentgenologic aspects of (1) both glandular and nutritional metabolic disturbances, (2) developmental disturbances, and (3) miscellaneous disturbances.

(*This course continued Tuesday, Course No. 10*)

Course No. 4: Monday, 8:30–10:00 A.M.

Roentgen Diagnosis of the Arthropathies

A. A. de LORIMIER, M.D.
Saint Francis Hospital, San Francisco

Casual observation of roentgenograms of joints may lead one to identify most cases either as atrophic or hypertrophic "arthritis." This stunted point of view may be due to improper technical precautions; it may be due to lack of comprehensive thinking with respect to the common types of arthropathies; it may be due to oversight of tangible roentgen criteria. These three aspects of responsibility on the part of roentgenologists will be considered, with portrayals by lantern slides.

(*This course continued Tuesday, Course No. 11*)

Course No. 5: Monday, 8:30–10:00 A.M.

Radium in Therapeutic Radiology

DOUGLAS QUICK, M.D.
New York, N. Y.

1. General discussion on reasons for using radium.

2. The relative values and adaptability of radium *vs.* x-radiation, together with the range of application and adaptability of each.
3. Technical principles and general plans or modes of usage.
4. Radium for internal application, as an elective procedure.
5. Radium for use in body cavities.
6. Radium for interstitial application, discussion to include both radon seeds and radium element needles.
   (*a*) Interstitial radium as the entire means of treatment.
   (*b*) Interstitial radium supplementing surgical removal either grossly complete or grossly incomplete.
7. Discussion of the philosophy of accurate localized interstitial irradiation *vs.* high-powered supervoltage radiation used in an attempt to accomplish the same end.

Course No. 6: Monday, 8:30–10:00 A.M.

Lesions of the Upper Gastro-Intestinal Tract

FREDERIC E. TEMPLETON, M.D.
School of Medicine, University of Washington
Seattle, Wash.

This course deals with the radiologic technic of examination and the diagnosis of lesions of the esophagus, stomach, and duodenum. In the technical portion the value and use of the spot-film device will be emphasized and advantages and disadvantages of the different types of equipment will be described. The relationship of fluoroscopy to the spot machine will be discussed in detail.

In the diagnostic portion, considerable time will be given to the discussion of peptic ulcer, the early diagnosis of carcinoma, and the differential diagnosis. The course will be profusely illustrated with lantern slides.

(*This course continued Tuesday, Course No. 13*)

Course No. 7: Monday, 8:30–10:00 A.M.

Dosimetry in Roentgen Therapy

GEORGE C. HENNY, M.D.
Temple University Hospital and Medical School
Philadelphia, Penna.

1. The variable factors in roentgen therapy.
   (*a*) Tissue susceptibility.
   (*b*) Quality of radiation.
   (*c*) Quantity of radiation.
   (*d*) Time.
2. Roentgen dose.
   (*a*) The roentgen: definition and meaning.
   (*b*) Energy relationships.
   (*c*) Tissue roentgen, roentgen equivalent physical (rep), etc.
3. Quality of the roentgen ray beam.
   (*a*) Determination of quality.
   (*b*) Specification of quality.
   (*c*) Effect of quality on biological response.
4. Tissue dose.
   (*a*) General considerations.
   (*b*) Surface or skin dose.
   (*c*) Depth or tumor dose.
   (*d*) Exit dose.
   (*e*) Isodose curves.
   (*f*) Multiple port technic or cross-firing.
5. Effects of technical factors on tissue dose.
   (*a*) Kilovolts, filter, distance, size of field, etc.
   (*b*) Absorption, scatter, and back-scatter.
6. Definition of terms.

Course No. 8: Monday, 8:30–10:00 A.M.

Venography

E. C. BAKER, M.D.
The Youngstown Hospital Association
Youngstown, Ohio

Past history will be reviewed. Venous anatomy, especially of the lower extremity, as shown by normal and abnormal venograms will be demonstrated. Emphasis will be placed on the physiology of blood flow as shown by serial venograms. Questions of technic will be considered. A number of pathological findings will be shown.

Course No. 9: Monday, 8:30–10:00 A.M.

Roentgen Diagnosis and Treatment of Neoplastic Disease in Childhood

EDWARD B. D. NEUHAUSER, M.D.
The Children's and The Infants' Hospitals and The Department of Radiology, Harvard Medical School
Boston, Mass.

Cancer in children is considerably more important than is generally conceded. It is one of the more important causes of death in infancy and childhood. Although children are susceptible to nearly all neoplastic processes that are seen in adults, this course will be limited chiefly to a discussion of tumors that are peculiar to or chiefly seen in childhood. Particular attention will be devoted to roentgen diagnosis, and a brief résumé of methods of treatment carried out at The Children's Hospital of Boston will be presented.

Course No. 10: Tuesday, 8:30–10:00 A.M.

Dental Roentgenology

S. A. LOVESTEDT, D.D.S.
Mayo Clinic, Rochester, Minn.

(*Continued from Monday, Course No. 3. See 3rd paragraph, Course No. 3*)

SUNDAY, Dec. 10 3–5 P.M.	MONDAY, Dec. 11 8:30–10 A.M.	TUESDAY Dec. 12 8:30–10 A.M.
1. **Therapy Information** James W. J. Carpender, M.D. Anna Hamann, M.D. Irving Hummon, M.D. Herbert Schmidt, M.D. Danley P. Slaughter, M.D. Eric Uhlmann, M.D. T. J. Wachowski, M.D., Moderator	3. **Dental Roentgenology (Continued Tuesday)** S. A. Lovestedt, D.D.S.	10. **Dental Roentgenology (Continued from Monday)** S. A. Lovestedt, D.D.S.
	4. **Roentgen Diagnosis of the Arthropathies (Continued Tuesday)** A. A. deLorimier, M.D.	11. **Roentgen Diagnosis of the Arthropathies (Continued from Monday)** A. A. de Lorimier, M.D.
	5. **Radium in Therapeutic Radiology.** Douglas Quick, M.D.	12. **The Pneumoconioses: Clinical, Radiological, and Pathological Evaluation.** Agrippa G. Robert, M.D.
	6. **Lesions of the Upper Gastrointestinal Tract (Continued Tuesday)** Frederic E. Templeton, M.D.	13. **Lesions of the Upper Gastrointestinal Tract (Continued from Monday)** Frederick E. Templeton, M.D.
7–9 P.M. 2. **Film Reading** Earl E. Barth, M.D. Earl R. Miller, M.D. Edward B. D. Neuhauser, M.D. Laurence L. Robbins, M.D. Leo G. Rigler, M.D., Moderator	7. **Dosimetry in Roentgen Therapy** George C. Henny, M.D.	14. **Dosimetry in Radium Therapy** Edith H. Quimby, Sc.D.
	8. **Venography** E. C. Baker, M.D.	15. **Cerebral Angiography** Earl R. Miller, M.D.
	9. **Roentgen Diagnosis and Treatment of Neoplastic Disease in Childhood** Edward B. D. Neuhauser, M.D.	16. **Application of Fundamental Principles of Radiation Therapy (Continued Wednesday)** Simeon T. Cantril, M.D.

PRESENTATION

WEDNESDAY, Dec. 13 8:30–10 A.M.	THURSDAY, Dec. 14 8:30–10 A.M.	FRIDAY, Dec. 15 8:30–10 A.M.
17. **Pneumoarthrography of the Knee** Wilbert H. McGaw, M.D. Maurice D. Sachs, M.D.	24. **Roentgenology of the Urinary Tract (Continued Friday)** Carl L. Gillies, M.D.	31. **Roentgenology of the Urinary Tract (Continued from Thursday)** Carl L. Gillies, M.D.
18. **Radiological Examination of the Obstetrical Patient (To be repeated Thursday)** Robert P. Ball, M.D.	25. **Radiological Examination of the Obstetrical Patient (Repetition of Course No. 18)** Robert P. Ball, M.D.	32. **Differential Diagnosis of Bone Tumors** Vincent W. Archer, M.D.
19. **Acute Diseases of the Chest** Aubrey O. Hampton, M.D.	26. **Radiological Findings in Abnormal Pulmonary Function** Robert P. Barden, M.D.	33. **Primary and Re-Infection Pulmonary Tuberculosis** C. C. Birkelo, M.D.
20. **Examination of the Colon** Robert D. Moreton, M.D.	27. **Roentgenologic Examination of the Small Intestine (Continued Friday)** Ross Golden, M.D. Lois C. Collins, M.D.	34. **Roentgenologic Examination of the Small Intestine (Continued from Thursday)** Ross Golden, M.D. Lois C. Collins, M.D.
21. **Dosimetry in the Use of Radioactive Isotopes** Otto Glasser, Ph.D.	28. **Diagnosis and Treatment of Malignant Tumors of the Female Genital Tract (Continued Friday)** Harold Wm. Jacox, M.D.	35. **Diagnosis and Treatment of Malignant Tumors of the Female Genital Tract (Continued from Thursday)** Harold Wm. Jacox, M.D.
22. **Cardiography** Fred Jenner Hodges, M.D. Melvin M. Figley, M.D. Walter M. Whitehouse, M.D.	29. **Skeletal Lesions in Infancy and Childhood (Continued Friday)** J. R. Hodgson, M.D. R. L. J. Kennedy, M.D.	36. **Skeletal Lesions in Infancy and Childhood (Continued from Thursday)** J. R. Hodgson, M.D. R. L. J. Kennedy, M.D.
23. **Application of Fundamental Principles of Radiation Therapy (Continued from Tuesday)** Simeon T. Cantril, M.D.	30. **Indications for and Results of Radiotherapy (X-rays and radium) in the Treatment of Cancer (Continued Friday)** William Harris, M.D.	37. **Indications for and Results of Radiotherapy (X-rays and Radium) in the Treatment of Cancer (Continued from Thursday)** William Harris, M.D.

Course No. 11: Tuesday, 8:30–10:00 A.M.

Roentgen Diagnosis of the Arthropathies

A. A. de LORIMIER, M.D.
Saint Francis Hospital, San Francisco

(*Continued from Monday, Course No. 4*)

Course No. 12: Tuesday, 8:30–10:00 A.M.

The Pneumoconioses: Clinical, Radiological, and Pathological Evaluation

AGRIPPA G. ROBERT, M.D.
The Baton Rouge General Hospital
Baton Rouge, La.

The changes within the lungs occurring as the result of inhaled dust will receive general discussion. The specific and non-specific pneumoconioses will be differentiated by definition and the criteria for their diagnosis detailed. Special emphasis will be placed upon the roentgenologic manifestations of the two currently recognized specific pneumoconioses, silicosis, and asbestosis, but relevant clinical and pathological findings will be included.

The differential diagnosis of the pneumoconioses from various other pulmonary diseases which may be productive of similar roentgenographic patterns will be covered. In this portion of the discussion some special consideration will be accorded to chronic pulmonary granulomatosis of beryllium workers.

Course No. 13: Tuesday, 8:30–10:00 A.M.

Lesions of the Upper Gastro-Intestinal Tract

FREDERIC E. TEMPLETON, M.D.
School of Medicine, University of Washington
Seattle, Wash.

(*Continued from Monday, Course No. 6*)

Course No. 14: Tuesday, 8:30–10:00 A.M.

Dosimetry in Radium Therapy

EDITH H. QUIMBY, Sc.D., Physicist
Columbia University, New York, N. Y.

The development of dosage units for radium therapy will be traced briefly. Various charts and tables for determination of dosage in roentgens will be presented, and precautions regarding their use discussed. Most of the period will be devoted to working out practical problems. An exhibit on dosage calculation will probably be presented.

Course No. 15: Tuesday, 8:30–10:00 A.M.

Cerebral Angiography

EARL R. MILLER, M.D.
University of California, San Francisco

This presentation will concern itself with matters of technic of cerebral angiography and dangers associated with the procedure. There will be a demonstration of the normal as well as patients showing disease, with discussion of the findings. The review will cover diseases which are primarily vascular, as well as some that are not.

Course No. 16: Tuesday, 8:30–10:00 A.M.

Application of Fundamental Principles of Radiation Therapy

SIMEON T. CANTRIL, M.D.
Tumor Institute of Swedish Hospital
Seattle, Wash.

I. General indications for radiation therapy.
Selection of the patient.
Palliative *vs.* curative therapy.
Choice of method of irradiation.
Combination of surgery with radiation therapy.
Combination of radium and x-ray therapy.

II. Fundamental principles.
Importance of diagnosis relative to the biologic properties and possible spread of the growth.
Stromal *vs.* tumor response and preservation of normal tissues.
Clinical guides to stromal and tumor response.
Protraction as a means of minimizing injury: its application and limitations.
Dose as a factor in radiation therapy.

III. Roentgen therapy.
Importance of the quality of radiation.
Selection of fields and their application.
Sparing injury to normal tissues.
Radiation sickness.
Early and late radiation reactions.
(The above illustrated by a discussion of management of cancer of the skin, lip, oral cavity, pharynx, and cervix.)

IV. Radium therapy.
Indications for radium therapy.
Intracavitary radium in cancer of the cervix.
Limitations of radium as a therapeutic agent.

V. Questions and discussions.

(*This course continued Wednesday, Course No. 23*)

Course No. 17: Wednesday, 8:30–10:00 A.M.

Pneumoarthrography of the Knee

WILBERT H. McGAW, M.D., and MAURICE D. SACHS, M.D.
Orthopedic and Radiological Services, Western Reserve University
School of Medicine, and Crile Veterans Administration Hospital, Cleveland, Ohio

I. Historical review of pneumoarthrography, with specific emphasis on the evolution of x-ray technic, including advantages and disadvantages of many contrast media.

REFRESHER COURSES

THE RADIOLOGICAL SOCIETY OF NORTH AMERICA

December 10 through December 15, 1950

PALMER HOUSE

CHICAGO, ILLINOIS

(Detach here)

To Register for the Refresher Courses

SEE INSTRUCTIONS ON REVERSE SIDE AND

FILL OUT THE FOLLOWING

(*Note:* **Courses are limited to members of the medical profession (M.D.'s) including graduate students and residents in Radiology, and to radiation physicists)**

(Print or type) .....M.D.

Last Name **First Name or Initials**

.....

Street Address

.....

City **State**

CHECK THE FOLLOWING

Member R.S.N.A. ☐ **Guest** ☐

Resident or Graduate Student in Radiology at present ☐

Where.....

Reserve Officer on Active Duty at present ☐

Fill out, also, the enrollment diagram on the reverse side of this page

INSTRUCTIONS FOR ENROLLMENT

IN REFRESHER COURSES

Read the accompanying description of the courses and plan of presentation. Register early; the number admitted to each course will be limited by the seating capacity of the rooms. Reservations will be made in the order of the receipt of request.

Tickets on reservations received prior to Dec. 5. will be mailed to you. After that date they will be held for you at the Registration Desk at the Palmer House.

FEES

Members: No charge.

Non-Members: $3.00 for each course up to maximum of $10.00 for entire series.

Graduate students and residents in Radiology, reserve officers on active duty: No charge.

(Fees must accompany applications)

PLEASE INDICATE YOUR FIRST, SECOND AND THIRD CHOICES

	First Choice		Second Choice		Third Choice	
	Course No.	Instructor	Course No.	Instructor	Course No.	Instructor
Sunday, Dec. 10 3 P.M.						
Sunday, Dec. 10 7 P.M.						
Monday, Dec. 11						
Tuesday, Dec. 12						
Wednesday, Dec. 13						
Thursday, Dec. 14						
Friday, Dec. 15						

Prior to Dec. 5, 1950, mail this order sheet to:

C. Edgar Virden, M.D., Chairman, Refresher Course Committee
320 West 47th St., Kansas City 2, Missouri

After Dec. 5, 1950, mail to:

C. Edgar Virden, M.D., c/o Radiological Society of North America
Palmer House Chicago, Ill.

II. Anatomy.
   (*a*) Studies of normal, gross, cross-section anatomy with emphasis on soft-tissue structures.
   (*b*) Studies of the anatomy as seen in pneumoarthrograms, with particular emphasis on soft-tissue structures such as menisci, articular cartilage, collateral and cruciate ligaments and bursa.
III. Technic of oxygen injection, as well as the taking of multiple roentgenographic views, to be demonstrated by a short movie.
IV. Orthopedic need for pneumoarthrography.
V. Pathology: General review of pneumoarthrograms compared with preserved specimens and colored slides.

Course No. 18: Wednesday, 8:30–10:00 A.M.

Radiological Examination of the Obstetrical Patient

ROBERT P. BALL, M.D.
The New York Hospital, New York, N. Y.

The radiologic examination of the obstetrical patient will be discussed and illustrated with lantern slides and charts. Emphasis will be placed upon the purposes of the examination and the technical requirements. The concept of a volumetric ratio between the size of the fetal cranium and the passage of the birth canal will be stressed.

(*This course will be repeated Thursday, Course No. 25*)

Course No. 19: Wednesday, 8:30–10:00 A.M.

Acute Diseases of the Chest

AUBREY O. HAMPTON, M.D.
Garfield Memorial Hospital
Washington, D. C.

1. Various types of acute pulmonary infection.
2. Pulmonary edema.
3. Aspiration pneumonia.
4. "Postoperative pneumonia."
5. Atelectasis.
6. Pulmonary embolism and infarction.
7. Acute bronchial occlusion.

Some of the more common conditions of the chest and mediastinum following thoracic surgery and esophagoscopy will also be discussed.

Course No. 20: Wednesday, 8:30–10:00 A.M.

Examination of the Colon

ROBERT D. MORETON
Tom B. Bond Radiological Group
Fort Worth, Texas

Examination of the colon will be discussed, with emphasis on preparation of the patient, types of barium mixture, indications for particular methods of examination, and the conduct of each method. Characteristic features of the more common pathological conditions will be covered, and illustrated with slides reproducing both single- and double-contrast films.

Course No. 21: Wednesday, 8:30–10:00 A.M.

Dosimetry in the Use of Radioactive Isotopes

OTTO GLASSER, Ph.D.
Cleveland Clinic, Cleveland, Ohio

A practical approach to the establishment of an isotope department will be presented. Emphasis will be placed upon rules of protection for patient and operator, as well as on calculation and application of proper dosages in treatment and tracer work.

Course No. 22: Wednesday, 8:30–10:00 A.M.

Cardiography

FRED JENNER HODGES, M.D.
MELVIN M. FIGLEY, M.D.
WALTER M. WHITEHOUSE, M.D.
University of Michigan, Ann Arbor, Mich.

In this hour the rationale and feasibility of injecting into the blood stream a mass of opaque material which can be followed radiographically in its course through the various cardiac chambers and the great vessels will be discussed. Briefly the steps in the development of existing technics will be reviewed.

Numerous examinations of normal and abnormal cardiovascular circulation will be illustrated from actual case material, and the precautions necessary to satisfactory results will be discussed. An attempt will be made to indicate the relative importance of angiocardiography in the entire range of diagnostic x-ray procedures.

Course No. 23: Wednesday, 8:30–10:00 A.M.

Application of Fundamental Principles of Radiation Therapy

SIMEON T. CANTRIL, M.D.
Tumor Institute of Swedish Hospital
Seattle, Wash.

(*Continued from Tuesday, Course No. 16*)

Course No. 24: Thursday, 8:30–10:00 A.M.

Roentgenology of the Urinary Tract

CARL L. GILLIES, M.D.
The State University of Iowa
Iowa City, Iowa

Session I. The Upper Urinary Tract: The roentgen diagnosis of congenital anomalies and renal disease producing abnormal findings on both plain films and pyelograms will be discussed. Differential diagnosis will be stressed. Lantern slides will be used.

Session II. The Lower Urinary Tract: The conditions involving the ureters will be briefly covered. Greater emphasis will be placed on the diagnosis and

sources of error in roentgen study of diseases of the bladder, prostate, and urethra. Lantern slides will be used.

(*This course continued Friday, Course No. 31*)

Course No. 25: Thursday, 8:30–10:00 A.M.

Radiological Examination of the Obstetrical Patient

ROBERT P. BALL, M.D.
The New York Hospital, New York, N. Y.

(*This course is a repetition of Course No. 18*)

Course No. 26: Thursday, 8:30–10:00 A.M.

Radiologic Findings in Abnormal Pulmonary Function

ROBERT P. BARDEN, M.D.
University of Pennsylvania, Philadelphia

An attempt will be made to demonstrate the possibility of interpreting physiologic abnormalities from radiologic examination. With the increase in knowledge of pulmonary function and rapid expansion of pulmonary surgery, anatomical diagnoses of chest conditions should no longer be the sole aim of radiologists. Information gained from pulmonary function studies will be correlated with roentgenograms in order to show how some qualitative information regarding function may be obtained where detailed physiological tests are not available. The concept of pulmonary insufficiency will be illustrated by examples of conditions which affect the peripheral vessels of the lung, and secondly by diseases resulting in abnormal ventilation of the lung, especially emphysema.

Course No. 27: Thursday, 8:30–10:00 A.M.

Roentgenologic Examination of the Small Intestine

ROSS GOLDEN, M.D.
LOIS C. COLLINS, M.D.
Presbyterian Hospital, New York

Discussion of the anatomy, physiology, and psychosomatic manifestations of diseases of the small intestine, including diseases of the mesentery, nutritional disorders, other conditions involving damage to the intramural nervous system, and neoplasms and inflammations.

(*This course continued Friday, Course No. 34*)

Course No. 28: Thursday, 8:30–10:00 A.M.

Diagnosis and Treatment of Malignant Tumors of the Female Genital Tract

HAROLD WILLIAM JACOX, M.D.
Presbyterian Hospital, New York

1. The natural course and incidence of only the common malignant conditions will be discussed:
   (*a*) Carcinoma of the cervix.
   (*b*) Carcinoma of the fundus.
   (*c*) Carcinoma of the ovary.
   (*d*) Carcinoma of the vulva.
2. Emphasis will be placed upon practical clinical fundamentals as a working basis.
3. The relationship of surgery to irradiation will be brought out.
4. The relationship of the various methods of irradiation will be considered.
5. Details and timing of technics used at the Presbyterian Hospital, New York City, will be reviewed from the standpoint of tissue dose estimation.
6. Complications will be considered with a view to minimizing them.
7. Time will be allowed for questions and discussions.

(*This course continued Friday, Course No. 35*)

Course No. 29: Thursday, 8:30–10:00 A.M.

Skeletal Lesions in Infancy and Childhood

J. R. HODGSON, M.D.
Section on Roentgenology, Mayo Clinic
and
R. L. J. KENNEDY, M.D.
Chief, Section on Pediatrics, Mayo Clinic

There are certain diseases associated with infancy and childhood which present characteristic findings in the roentgenograms of the skeleton. The chief roentgenologic manifestations of disease in infants and children with respect to bones will be considered under the following broad classification:

1. Developmental anomalies and related conditions.
2. The effects of endocrine disturbances on bones.
3. Infectious disease involving bone.
4. Neoplasms involving the skeletal system.
5. Miscellaneous lesions of bone in infants and children.

The various diseases will be considered from the roentgenologic point of view by Dr. Hodgson, and Dr. Kennedy will interject pertinent comments regarding the clinical and pathologic aspects of the subjects considered.

(*This course continued Friday, Course No. 36*)

Course No. 30: Thursday, 8:30–10:00 A.M.

Indications for and Results of Radiotherapy (X-Rays and Radium) in the Treatment of Cancer

WILLIAM HARRIS, M.D.
New York, N. Y.

This course will review the present indications and contraindications for radiotherapy in the treatment of cancer.

Lesions which will respond to, and in which the cure rate is better with other forms of treatment, such as surgery, will be discussed. The major forms of cancer which confront the physician will be pre-

sented. Cancer of the skin, upper respiratory tract, lungs, breast, and genito-urinary tract will be included in the two lectures.

The technical approach and place and relationship of radium and x-ray in the management of the various lesions enumerated above will be discussed.

The results of modern radiotherapy, either alone or combined with surgery, will also be analyzed.

(*This course continued Friday, Course No. 37*)

Course No. 31: Friday, 8:30–10:00 A.M.

Roentgenology of the Urinary Tract

CARL L. GILLIES, M.D.
The State University of Iowa
Iowa City, Iowa

(*Continued from Thursday, Course No. 24*)

Course No. 32: Friday, 8:30–10:00 A.M.

Differential Diagnosis of Bone Tumors

VINCENT W. ARCHER, M.D.
University of Virginia
Charlottesville, Va.

The subject will be presented under four headings: (*a*) benign tumors, (*b*) primarily malignant tumors, (*c*) benign tumors which have undergone malignant degeneration, (*d*) simulants of malignant growth, with differential features when possible.

A very brief clinical summary will be presented with each example shown, tying in the history, physical examination, laboratory work, radiological findings, and pathology.

Cases shown will be:

A. *Benign Bone Tumors:*
(1) Osteitis fibrosa cystica, (2) chondromatous giant-cell tumor (Codman's tumor), (3) osteoid osteoma, (4) bone cyst, (5) benign giant-cell tumor, (6) fibrous dysplasia, (7) xanthomatosis (Schüller-Christian's), (8) Gaucher's disease, (9) Boeck's sarcoid, (10) Brodie's abscess.

B. *Malignant Bone Tumors*
(11) Ewing's, (12) malignant giant-cell tumor, (13) malignant osteolytic giant-cell tumor, (14) sclerosing osteogenic sarcoma, (15) chordoma, (16) Hodgkin's, (17) typical bone sarcoma, (18) chondrosarcoma, (18*a*) multiple myeloma.

C. *Malignant Degeneration*
(19) Giant-cell, (20) Paget's, (21) chronic osteomyelitis, (22) chondroma.

D. *Simulants of Malignant Lesions*
(23) Chronic osteomyelitis, (24) fibrous dysplasia, (25) Brodie's abscess, (26) osteomyelitis again, (27) actinomycosis, (28) osteitis condensans ilii, (29) Pellegrini-Stieda's disease, (30) tarsal tuberculosis, (31) gumma of sternum, (32) syphilitic osteoperiostitis.

Course No. 33: Friday, 8:30–10:00 A.M.

Primary and Reinfection Pulmonary Tuberculosis

C. C. BIRKELO, M.D.
Herman Kiefer Hospital
Detroit, Mich.

This will consist of a lantern slide demonstration of the various types of lesions found, both of the common and unusual types. The National Standards of Classification will be discussed. Special attention and emphasis will be given to differential diagnosis, as well as the need for accurate localization of all types of pulmonary lesions.

Course No. 34: Friday, 8:30–10:00 A.M.

Roentgenologic Examination of the Small Intestine

ROSS GOLDEN, M.D.
LOIS C. COLLINS, M.D.
Presbyterian Hospital, New York

(*Continued from Thursday, Course No. 27*)

Course No. 35: Friday, 8:30–10:00 A.M.

Diagnosis and Treatment of Malignant Tumors of the Female Genital Tract

HAROLD WILLIAM JACOX, M.D.
Presbyterian Hospital, New York

(*Continued from Thursday, Course No. 28*)

Course No. 36: Friday, 8:30–10:00 A.M.

Skeletal Lesions in Infancy and Childhood

J. R. HODGSON, M.D.
Section on Roentgenology, Mayo Clinic
and
R. L. J. KENNEDY, M.D.
Chief, Section on Pediatrics, Mayo Clinic

(*Continued from Thursday, Course No. 29*)

Course No. 37: Friday, 8:30–10:00 A.M.

Indications for and Results of Radiotherapy (X-Rays and Radium) in the Treatment of Cancer

WILLIAM HARRIS, M.D.
New York, N. Y.

(*Continued from Thursday, Course No. 30*)

ANNOUNCEMENTS AND BOOK REVIEWS

PITTSBURGH ROENTGEN SOCIETY

At a recent meeting of the Pittsburgh Roentgen Society the following officers were elected for the ensuing year: President, Eva S. Carey, M.D.; Vice-President, Lester M. J. Freedman, M.D.; Secretary, Edwin J. Euphrat, M.D., 3500 Fifth Ave., Pittsburgh 13; Treasurer, Alan R. Brown, M. D.

SOCIEDAD DE RADIOLOGIA, CANCEROLOGIA Y FISICA MEDICA DEL URUGUAY

The following officers have recently been elected by the Society of Radiology, Cancer, and Physical Medicine of Uruguay: Prof. Dr. Alfonso C. Frangella, President; Prof. Dr. Leandro Zubiaurre, Vice-President; Dr. Manuel Arias Bellini, Secretary General; Prof. Dr. Rodolfo Tiscornia, Recording Secretary; Dr. Luis A. Vásquez Piera, Treasurer; Drs. Raúl Leborgne and Agustín Gorlero Armas, Members of the Board of Directors.

Headquarters of the Society are at Av. Agraciada 1464, Piso 13, Montevideo.

THE THIRD INTER-AMERICAN CONGRESS OF RADIOLOGY

Though some time has passed since the Third Inter-American Congress of Radiology, it still seems fitting to publish a brief account of the meeting. The Congress was held in Santiago and Viña del Mar, Chile, Nov. 11 to 18, 1949, under the presidency of Dr. Félix J. Daza B. The first six days were spent in Santiago at the Hotel Crillon, after which the meeting adjourned to Viña del Mar, a watering place on the Pacific coast near Valparaiso, where the final sessions convened.

About 110 radiologists outside of Chile were registered for the meeting, the largest delegation being from the Argentine Republic. Twenty-two delegates from the United States were present, many of them with their wives. The official delegation recognized by the U. S. Department of State included Dr. Philip J. Hodes, Dr. Maurice Lenz, Dr. Egon Lorenz, Dr. Edith H. Quimby, Dr. Juan A. del Regato, Dr. Waldron M. Sennott, and Dr. James T. Case.

Some distinguished European guests were also present, including Dr. and Mrs. H. Graham Hodgson, of London, Treasurer of the Sixth International Congress of Radiology, who on behalf of the radiologists of Great Britain presented the Inter-American Congress with a gavel; Dr. Elis Berven, of Stockholm, Dr. Francis Perrin, of Paris, and Dr. Ernst G. Mayer, of Vienna.

At the opening meeting in the Hall of Honor of the University of Chile, there were addresses of welcome by various officials, including Dr. Armando Cabrera, of Havana, representing Dr. Pedro L. Fariñas, President of the Second Inter-American Congress of Radiology, who was unable to be present, and Dr. Félix J. Daza B., President of the Third Inter-American Congress. Responses were made by Dr. Agustín Benavides Cana, of the Bolivian delegation, in behalf of the delegates from the Spanish-speaking countries; Dr. Cabello Campos, one of the delegates from Brazil, spoke for the Portuguese language delegates, and the writer for the delegates from the English-speaking countries.

After our own response to the address of welcome, we stepped down to the Table of Honor and presented Dr. Daza with the Presidential Badge and Chain which had been prepared for the ceremony, a formality which made a very favorable impression on the audience. Many of our Latin American friends commented afterwards on the appropriateness of the gesture and the fine spirit it represented on behalf of the radiologists of the United States and, particularly, the American College of Radiology.

The first general meeting included the official themes: "Cancer of the Tongue" by Dr. Elis Berven and "Radioactive Isotopes and Cancer" by Dr. Edith H. Quimby, who had been made a special guest of the Congress and who won the affection and admiration of all. Dr. Francis Perrin of Paris made a long address, in French, on "The Development of Atomic Energy in France."

One session was devoted to Contrast Radiography of the Cardiovascular System, with important contributions from the Cuban delegation aided by others. Diagnostic and Simple Exploratory Radiography of the Skull occupied another session. Dr. H. Graham Hodgson discussed infections of the temporal bone and Dr. Philip Hodes and Dr. E. P. Pendergrass, meningiomas. Dr. C. Viviani, of Santiago, a distinguished student of Dr. Mayer, offered an extensive and valuable exhibit and paper on the radiologic exploration of the organs of hearing. The Argentine group made an especially valuable contribution to the subject of simple radiologic exploration of the skull.

The number of free themes (not related to the previously arranged subjects for main discussions) were varied and interesting and were contributed by members from Argentina, Brazil, Colombia, the Dominican Republic, Mexico, Peru, and the United States.

Cancer of the Tongue was further discussed by representatives from Brazil, Chile, Cuba, and the United States, the latter including Dr. Maurice Lenz of New York and Dr. Harold E. Davis and Dr. Irvin F. Hummon, Jr., of Chicago. The fourth main theme, "Cancer of the Uterine Cervix," was discussed in great detail by the group from Argentina and representatives from Chile, Colombia, Cuba, Guatemala, and the United States. No other subject received as much attention.

The final session of the Congress was devoted to the ceremony put on by the members from the United States for the Honorary Fellows of the American College of Radiology whom we were authorized to invest: Dr. S. Di Rienzo, Dr. Eduardo Lanari, Dr. Gonzalo Esguerra Gómez, Dr. Félix J. Daza B., Dr. Leonardo Guzmán, and Dr. Luis Opazo. Honorary Fellowship was conferred *in absentia* on Dr. Humberto H. Carelli, Dr. Alfonso C. Frangella, and Dr. Oscar Soto.

The Third Inter-American Congress of Radiology, complying with the suggestion made at the time of the Second Inter-American Congress in Havana, voted to hold the next meeting, the fourth, in Mexico City. Two official themes fixed in advance for the Fourth Congress include: (A) Radiotherapy of Lymphoblastomas (Lymphosarcoma, Hodgkin's Disease, and Leukemia); (B) Radiologic Diagnosis of Abdominal Tumors except Tumors of the Digestive Tube. The local program committee will have freedom to arrange the rest of the program.

The program of entertainment was extensive. The festivities included a luncheon given by the Chilean members of the Executive Committee of the Congress, a barbecue and picnic offered by one of the leading producers of Chilean wines at the popular Fundo de Pirque, a reception to the delegations by Mr. Frank C. Westcott, the official banquet, a cocktail party given by the United States delegation, and a reception by the Mayor of Viña del Mar.

Our Mexican colleagues are beginning to publicize the Fourth Inter-American Congress of Radiology which will take place sometime in 1952. The Committee of Organization for this Fourth Congress has announced the following officers: President, Dr. Manuel F. Madrazo; General Secretary, Dr. Guido Torres Martínez; Secretary General for Latin America, Dr. Narno Dorbecker C.; Secretary General for the United States and Canada, Dr. Guillermo Santin; Treasurer, Dr. Baudolio Villanueva.

JAMES T. CASE, M.D.

Books Received

Books received are acknowledged under this heading, and such notice may be regarded as recognition of the courtesy of the sender. Reviews will be published in the interest of our readers and as space permits.

BONE AND JOINT DISEASES. PATHOLOGY CORRELATED WITH ROENTGENOLOGICAL AND CLINICAL FEATURES By J. VERNON LUCK, M.S. (Ortho.), M.D., F.A.C.S., F.I.C.S., Assistant Clinical Professor of Orthopedic Surgery, University of Southern California; Senior Attending Physician, Department of Orthopedic Surgery, and Consultant in Orthopedic Pathology, Los Angeles County Hospital; Member, Subcommittee in Orthopedic Surgery, National Research Council; Member, Board of Associate Editors, Journal of Bone and Joint Surgery. A volume of 614 pages, with 703 illustrations, including 21 in color. Charles C Thomas, Springfield, Ill., 1950. Price $16.50.

DIAGNOSIS AND TREATMENT OF TUMORS OF THE HEAD AND NECK (NOT INCLUDING THE CENTRAL NERVOUS SYSTEM). By GRANT E. WARD, M.D., D.Sc., F.A.C.S., and JAMES W. HENDRICK, M.D., M.S. with Forewords by Arthur M. SHIPLEY, M.D., and ALFRED BLALOCK, M.D. From the Departments of Surgery of the School of Medicine, University of Maryland, and the Johns Hopkins University School of Medicine, and the Oncology Clinic of the University Hospital and the Tumor Clinic of the Johns Hopkins Hospital. A volume of 832 pages, with 637 figures and 9 color plates. The Williams & Wilkins Co., Baltimore, Md., 1950. Price $15.00.

MALIGNANT DISEASE AND ITS TREATMENT BY RADIUM. By SIR STANFORD CADE, K.B.E., C.B., F.R.C.S., M.R.C.P., Surgeon, Westminster Hospital; Consulting Surgeon, Mount Vernon Hospital and Radium Institute; Lecturer in Surgery, University of London; Member of the Council and of the Court of Examiners, late Hunterian Professor and Arris and Gale Lecturer, Royal College of Surgeons of England; Hon. Member, American Radium Society; Consultant in Surgery to the Royal Air Force. With a Foreword by SIR ERNEST ROCK CARLING, F.R.C.P., F.R.C.S., F.F.R., Consulting Surgeon and Vice-President, Westminster Hospital. Second edition, Vol. III. One hundred and eighty-two figures, many in color. The Williams & Wilkins Co., Baltimore, Md., 1950.

ATTI DEL XVI CONGRESO NAZIONALE DI RADIOLOGIA MEDICA, Taormina, 15–18 Maggio 1950. Vol. I, PART I, LA RADIODIAGNOSTICA DEI TUMORI CEREBRALI. By PROF. FERMO MASCHERPA. 126 pages, 124 illustrations. Vol. I, Part II, LA RADIOTERAPIA DEI TUMORI MALIGNI DEL SISTEMA RETICOLOENDOTELIALE. By PROF. GIOVANNI F. GARDINI. 78 pages. Vol. I, Part III, RADIOTERAPIA E RADIOBIOLOGIA DEI TUMORI DELLE OSSA. By PROF. ADAMO GRILLI. 202 pages, 57 illustrations. Published by Societa Italiana di Radiologia Medica, Abruzzini Editore, Rome, 1950.

Book Reviews

CLINICAL THERAPEUTIC RADIOLOGY. U. V. PORTMANN, M.D., Editor, Head of Department of Therapeutic Radiology, Cleveland Clinic Foundation; Professor of Therapeutic Radiology, Bunts Educational Institute, Cleveland. A volume of 748 pages, with numerous illustrations.

Published by Thomas Nelson & Sons, New York, 1950. Price $15.00.

Clinical Therapeutic Radiology is a highly satisfactory book, of which one chapter alone—that on tumors of the testis—is worth the whole cost. The impressive array of authors—fifty-three—is sufficient testimonial to the value of the work. As in many texts of this order (symposia), the individual contributions are familiar, resembling previous writings in journals and textbooks. Pet interests and attitudes are conspicuous.

The reader may indulge his enthusiasms: he will find an unusually comprehensive section on the skeletal system, joints, and soft tissues, an illuminating chapter on supervoltage radiation, with an especially lucid account of the physical principles, and a discussion of diseases of the central nervous system, which, though simplified, provides an excellent basis for understanding the radiotherapeutic approach.

The work is attractive in format, with good illustrations, adequate author and subject indexes, and the usual long bibliography. It should be in the hands of every therapeutic radiologist and every resident radiologist.

SUPERVOLTAGE ROENTGENTHERAPY. By FRANZ BUSCHKE, M.D., SIMEON T. CANTRIL, M.D., and HERBERT M. PARKER, M.Sc. From the Tumor Institute of The Swedish Hospital, Seattle, Wash. A volume of 298 pages, with 260 illustrations, including 20 plates in color. Published by Charles C Thomas, Springfield, Ill., 1950. Price $10.50.

This volume from the Tumor Clinic of the Swedish Hospital, Seattle, is interesting not merely because of the primary subject matter, but also because it is adorned with critical considerations of radiotherapeutic problems in general.

The authors describe much of their eight years experience in tumor therapy with an 800-kv.p. machine having a pulsating-type potential and an effective quantum energy of 500 kv. They play down its advantage of moderately improved depth dose but emphasize the greater advantage of "restriction of radiation to the geometric beam," or beam-sharpness, which lessens exposure of normal structures and improves treatment efficiency in so far as the latter is represented by the ratio of energy absorbed in the tumor to the total body absorption; secondly, they emphasize the "marked reduction in skin damage" as compared with conventional deep therapy.

Separate chapters are devoted to carcinoma of the mouth, cancer of the pharynx, carcinoma of the esophagus, antrum, larynx, bladder, breast, cervix uteri, and tumors of the pituitary. It is interesting to compare the chapter on laryngeal carcinoma, describing a one-field technic, with the recent monograph by Baclesse (reviewed in Radiology **54:** 887, June 1950). The attitudes toward carcinoma of the breast and external roentgen therapy in lesions of the cervix should provoke definite reader-reactions. An effective two-field procedure for pituitary lesions is presented, together with a critique of surgical and lower-voltage therapy. One is struck by the sincerity and restraint of the authors and not less by their occasional chastising of ill-advised physicians and methods.

Supervoltage Roentgentherapy is mandatory reading for the student of radiotherapy.

MEDICAL PHYSICS. VOLUME II. Editor-in-Chief, OTTO GLASSER, Ph.D., F.A.C.R., Diplomate in Radiological Physics, American Board of Radiology; Professor of Biophysics, Frank E. Bunts Educational Institute; Head, Department of Biophysics, Cleveland Clinic Foundation; Consultant, U. S. Veterans Administration, Washington, D. C. Associate Editors: All contributors to Volumes I and II. Editorial Assistant, Jessie C. Tucker, Cleveland, Ohio. A volume of 1,228 pages, with 978 illustrations. Published by the Year Book Publishers, Inc., Chicago, Ill., 1950. Price $25.00.

One might have thought this second volume of *Medical Physics* a misnamed second edition, but it is rather a "complement and supplement" to Volume I, as the editor carefully explains in the preface. Briefly, the new volume contains: (1) a large measure of new material, much of it about nuclear physics, (2) additions to the previous discussions, and (3) title references alone, where the subject is covered in Volume I and requires neither revision nor addition. This plan—to exclude simple repetition—has permitted an up-to-date volume no larger than the original. Subjects are in alphabetic sequence, and there is a lengthy index.

As an established work of reference, *Medical Physics* scarcely needs a reviewer's boost, but there are no doubt those, easily intimidated by great bulk in books, who have passed up this fascinating and limitlessly useful encylopedia. Whether one needs data on technic of body measurements in anthropology, or the nature and purpose of statistical methods in biology, whether he would like to know how to mount biologic specimens in plastic or learn the principles of aerosol therapy, even if he is interested in the physical principles of blood flow, or the nature and use of Geiger counters, or how to prevent bedsores with a special mattress, these data are available in the new volume. And the discussions are not over-brief, but are in good prose and interestingly written. Thus in the article on Ecology we find the philosophic observation that "man, by virtue of numbers and technologic power, has become virtually a geologic force."

Volume II is an indispensable companion to Volume I. Both should be available to all physicians.

APERÇUS ROENTGENTHÉRAPIQUES RELATIFS Á DIVERS MODES D'INVOLUTION CANCÉREUSE, ET MÉTHODES DE PROTECTION. By DR. HENRI COUTARD, with the collaboration of DR. MACMULLEN, Director of the Penrose Tumor Clinic, Colorado Springs, Colo. A volume of 226 pages, with 6 illustrations. Published by G. Goin & Cie, Paris, 1949. Price 1,200 fr.

Whenever a physician of long experience, who for many years has done outstanding work in the field of his choice, undertakes to write a book, this book usually is worth reading, and sometimes it is worth careful study. This is notably true of this work by Coutard who, as every therapeutic radiologist knows, has contributed so much to the advancement and improvement of therapeutic radiology, especially in relation to malignant tumors of the mouth, pharynx, and larynx, as well as to the uterus.

The book is divided into five chapters, of which the first is devoted to Curable Cancers and Radioepithelitis (Mitogenetic Substance and Ovular Periodicity); the second deals with Incurable Cancers as Treated by Ancient Methods of Roentgen Therapy and the Anti-Mitogenetic Substance; the third, with Why Modifications in the Territory Invaded by Cancers Composed of Differentiated Cells Render Direct Irradiation Ineffective and Lead to Treatment with Protection; the fourth, with Rational Roentgen Therapy and Protection, in Relation to the Periodicity of the Anti-Mitogenetic Substance and the Pre-Neoplastic Period; and the fifth chapter, with The Beginnings of Rational Roentgen Therapy.

The book, which is rather small, is well printed on good paper and has a good cloth binding. To attempt to review the work, in the sense of trying to give the reader a reasonable understanding of the ideas which Coutard has developed, would require more space than the editor could reasonably be expected to allow. But the reviewer does not hesitate to urge every therapeutic radiologist who can read French to study this book carefully, because the ideas therein propounded may well lead to major modifications in therapeutic radiology. It may well prove to be a landmark in this field, and it may mark the end of the mechanical or "standardized" treatment of malignant tumors which has been prevalent for so long a time. Coutard has done it before and he has done it again. Not only has he shown himself to be a careful and thorough observer, but he has never ceased to study his observations closely and to try to understand them.

LEHRBUCH DER RÖNTGENOLOGISCHEN DIFFERENTIALDIAGNOSTIK. By WERNER TESCHENDORF, Köln, Germany. BAND I. ERKRANKUNGEN DER BRUSTORGANE (a volume of 780 pages, with 865 illustrations). BAND II. ERKRANKUNGEN DER BAUCHORGANE (a volume of 608 pages with 1,081 illustrations). Published by George Thieme, Stuttgart. Agents for the United States: Grune & Stratton, Inc., New York. 2d ed., 1950.

In these two volumes, written in German, the author attempts to discuss the various possible diseases that may cause a given picture in the roentgenogram. In this respect the book is quite similar to some of the works on differential diagnosis of symptoms used in internal medicine.

The first volume is concerned with the thorax, and takes into consideration different roentgenographic pictures seen in diseases of the lungs, heart, esophagus, other mediastinal structures, and the diaphragm. In the second volume, acute abdominal processes, diseases of the stomach, small intestine, colon, and bile passages are discussed. There is also a small section on urologic roentgenology. The head and neck and the bones and joints are not included.

This work may certainly be recommended for the trainee in diagnostic roentgenology who may constantly wonder how many diseases may present given roentgenographic signs. As a compendium of differential roentgen diagnosis and as a reference work in roentgen diagnosis as it concerns the viscera, the book should find a definite field of usefulness. A translation into English would be very worth while.

RADIOLOGICAL SOCIETIES: SECRETARIES AND MEETING DATES

Editor's Note: Secretaries of state and local radiological societies are requested to co-operate in keeping this section up-to-date by notifying the editor promptly of changes in officers and meeting dates.

RADIOLOGICAL SOCIETY OF NORTH AMERICA. *Secretary-Treasurer*, Donald S. Childs, M.D., 713 E. Genesee St., Syracuse 2, N. Y.

AMERICAN RADIUM SOCIETY. *Secretary*, John E. Wirth, M.D., Baltimore, Md.

AMERICAN ROENTGEN RAY SOCIETY. *Secretary*, Barton R. Young, M.D., Germantown Hospital, Philadelphia 44, Penna.

AMERICAN COLLEGE OF RADIOLOGY. *Secretary*, William C. Stronach, 20 N. Wacker Dr., Chicago 6, Ill.

SECTION ON RADIOLOGY, A. M. A. *Secretary*, Paul C. Hodges, M.D., 950 East 59th St., Chicago 37.

Alabama

ALABAMA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, W. D. Anderson, M.D., 420 10th St., Tuscaloosa.

Arizona

ARIZONA ASSOCIATION OF PATHOLOGISTS AND RADIOLOGISTS. *Secretary*, R. Lee Foster, M.D., 507 Professional Bldg., Phoenix.

Arkansas

ARKANSAS RADIOLOGICAL SOCIETY. *Secretary*, Fred Hames, M.D., Pine Bluff. Meets every three months and at meeting of State Medical Society.

California

CALIFORNIA MEDICAL ASSOCIATION, SECTION ON RADIOLOGY. *Secretary*, Sydney F. Thomas, M.D., Palo Alto Clinic, Palo Alto.

EAST BAY ROENTGEN SOCIETY. *Secretary*, Dan Tucker, M.D., 434 30th St., Oakland 9. Meets monthly, first Thursday, at Peralta Hospital.

LOS ANGELES RADIOLOGICAL SOCIETY. *Secretary*, Harold P. Tompkins, M.D., 658 South Westlake Ave. Meets monthly, second Wednesday, County Society Bldg.

NORTHERN CALIFORNIA RADIOLOGICAL CLUB. *Secretary*, Clifford W. Wauters, 701 High St., Auburn. Meets at dinner last Monday of September, November, January, March, and May.

PACIFIC ROENTGEN SOCIETY. *Secretary*, L. Henry Garland, M.D., 450 Sutter St., San Francisco 8. Meets annually with State Medical Association.

SAN DIEGO ROENTGEN SOCIETY. *Secretary*, R. F. Niehaus, M.D., 1831 Fourth Ave., San Diego. Meets first Wednesday of each month.

X-RAY STUDY CLUB OF SAN FRANCISCO. *Secretary*, Merrell A. Sisson, M.D., 450 Sutter St., San Francisco 8. Meets third Thursday at 7:45, January to June at Stanford University Hospital, July to December at San Francisco Hospital.

Colorado

COLORADO RADIOLOGICAL SOCIETY. *Secretary*, Paul E. RePass, M.D., 306 Republic Bldg., Denver 2. Meets monthly, third Friday, at University of Colorado Medical Center or Denver Athletic Club.

Connecticut

CONNECTICUT STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary*, Fred Zaff, M.D., 135 Whitney Ave., New Haven. Meetings bimonthly, second Wednesday.

CONNECTICUT VALLEY RADIOLOGICAL SOCIETY. *Secretary*, Ellwood W. Godfrey, M.D., 1676 Boulevard, W. Hartford. Meets second Friday of October and April.

District of Columbia

RADIOLOGICAL SECTION, DISTRICT OF COLUMBIA MEDICAL SOCIETY. *Secretary*, Karl C. Corley, M.D., 1835 Eye St., N.W., Washington 6. Meets third Thursday, January, March, May, and October, at 8:00 P.M., in Medical Society Auditorium.

Florida

FLORIDA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John J. McGuire, M.D.,1117 N. Palafox, Pensacola. Meets in April and in November.

GREATER MIAMI RADIOLOGICAL SOCIETY. *Secretary*, David Kirsh, M.D., 712 duPont Bldg., Miami 32. Meets monthly, last Wednesday, 8:00 P.M.

Georgia

ATLANTA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Ted F. Leigh, M.D., Emory University Hospital. Meets second Friday, September to May.

GEORGIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Robert C. Pendergrass, M.D., Americus. Meets in November and at the annual meeting of State Medical Association.

Illinois

CHICAGO ROENTGEN SOCIETY. *Secretary*, Benjamin D. Braun, M.D., 6 N. Michigan Ave., Chicago 11. Meets at the University Club, second Thursday of October, November, January, February, March, and April at 8:00 P.M.

ILLINOIS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, William DeHollander, M.D., St. Johns' Hospital, Springfield. Meetings quarterly as announced.

ILLINOIS STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary*, Willard C. Smullen, M.D., St. Mary's Hospital, Decatur.

Indiana

INDIANA ROENTGEN SOCIETY. *Secretary-Treasurer*, William M. Loehr, M.D., 712 Hume-Mansur Bldg., Indianapolis 4. Annual meeting in May.

Iowa

IOWA X-RAY CLUB. *Secretary*, Arthur W. Erskine, M.D., 326 Higley Building, Cedar Rapids. Meets during annual session of State Medical Society.

Kansas

KANSAS RADIOLOGICAL SOCIETY. *Secretary*, Anthony F. Rossitto, M.D., Wichita Hospital, Wichita. Meets annually with State Medical Society.

Kentucky

LOUISVILLE RADIOLOGICAL SOCIETY, *Secretary*, Everett L. Pirkey, M.D., Louisville General Hospital. Meets monthly, second Friday, at Seelbach Hotel.

Louisiana

LOUISIANA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Johnson R. Anderson, M.D., No. Louisiana Sanitarium, Shreveport. Meets with State Medical Society.

ORLEANS PARISH RADIOLOGICAL SOCIETY. *Secretary*, Joseph V. Schlosser, M.D., Charity Hospital of Louisiana, New Orleans 13. Meets first Tuesday of each month.

SHREVEPORT RADIOLOGICAL CLUB, *Secretary*, Oscar O. Jones, M.D., 2622 Greenwood Road. Meets monthly September to May, third Wednesday.

Maine

MAINE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Clark F. Miller, M.D., Central Maine General Hospital, Lewiston.

Maryland

BALTIMORE CITY MEDICAL SOCIETY, RADIOLOGICAL SECTION. *Secretary*, J. Howard Franz, M.D., 1127 St. Paul St., Baltimore 2.

Michigan

DETROIT X-RAY AND RADIUM SOCIETY. *Secretary*, George Belanger, M.D., Harper Hospital, Detroit 1. Meetings first Thursday, October to May, at Wayne County Medical Society club rooms.

MICHIGAN ASSOCIATION OF ROENTGENOLOGISTS. *Secretary-Treasurer*, R. B. MacDuff, M.D., 220 Genesee Bank Building, Flint 3.

Minnesota

MINNESOTA RADIOLOGICAL SOCIETY. *Secretary*, Leo A. Nash, M.D., 572 Lowry Medical Arts Bldg., St. Paul 2. Meets in Spring and Fall.

Missouri

RADIOLOGICAL SOCIETY OF GREATER KANSAS CITY. *Secretary*, Wm. M. Kitchen, M.D., 1010 Rialto Building, Kansas City 6, Mo. Meetings last Friday of each month.

ST. LOUIS SOCIETY OF RADIOLOGISTS. *Secretary*, H. R. Senturia, M.D., Pasteur Medical Bldg. Meets on fourth Wednesday, October to May.

Nebraska

NEBRASKA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John E. Downing, M.D., 816 Medical Arts Bldg., Omaha. Meets fourth Thursday of each month at 6 P.M. in Omaha or Lincoln.

New England

NEW ENGLAND ROENTGEN RAY SOCIETY. *Secretary*, L. L. Robbins, M.D., Massachusetts General Hospital, Boston 14. Meets monthly on third Friday at the Harvard Club.

New Hampshire

NEW HAMPSHIRE ROENTGEN SOCIETY. *Secretary*, Albert C. Johnston, M.D., Elliot Community Hospital, Keene. Meetings quarterly in Concord.

New Jersey

RADIOLOGICAL SOCIETY OF NEW JERSEY. *Secretary*, Peter J. Gianquinto, M.D., 685 High St., Newark 2. Meets at Atlantic City at time of State Medical Society and midwinter in Elizabeth.

New York

ASSOCIATED RADIOLOGISTS OF NEW YORK, INC. *Secretary*, William J. Francis, M.D., East Rockaway.

BROOKLYN ROENTGEN RAY SOCIETY. *Secretary*, J. Daversa, M.D., 603 Fourth Ave., Brooklyn. Meets fourth Tuesday, October to April.

BUFFALO RADIOLOGICAL SOCIETY. *Secretary-Treasurer*. Mario C. Gian, M.D., 610 Niagara St., Buffalo 1. Meetings second Monday, October to May.

CENTRAL NEW YORK ROENTGEN SOCIETY. *Secretary*, Dwight V. Needham, M.D., 608 E. Genesee St., Syracuse 10. Meetings January, May, October.

KINGS COUNTY RADIOLOGICAL SOCIETY. *Secretary*, Marcus Wiener, M.D., 1430 48th St., Brooklyn 19. Meetings fourth Thursday evening, October to May, at 8:45 P.M., in Kings County Medical Bldg.

NEW YORK ROENTGEN SOCIETY. *Secretary*, John L. Olpp, M.D., 49 Ivy Lane, Tenafly, N. J.

QUEENS ROENTGEN RAY SOCIETY. *Secretary*, Jacob E. Goldstein, M.D., 88–29 163rd St., Jamaica 3. Meets fourth Monday of each month.

ROCHESTER ROENTGEN-RAY SOCIETY. *Secretary-Treasurer*, A. Vaughn Winchell, M.D., 40 Meigs St. Meets at Strong Memorial Hospital, last Monday of each month, September through May.

North Carolina

RADIOLOGICAL SOCIETY OF NORTH CAROLINA. *Secretary*, James E. Hemphill, M.D., Professional Bldg., Charlotte 2. Meets in May and October.

North Dakota

NORTH DAKOTA RADIOLOGICAL SOCIETY. *Secretary*, Charles Heilman, M.D., 807 Broadway, Fargo.

Ohio

OHIO STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Edward C. Elsey, M.D., 927 Carew Tower, Cincinnati 2. Meets with State Medical Association.

CENTRAL OHIO RADIOLOGICAL SOCIETY. *Secretary*, Frank A. Riebel, M.D., 15 W. Goodale St., Columbus. Meets second Thursday, October, December, February, April, and June, 6:30 P.M., Columbus Athletic Club, Columbus.

CINCINNATI RADIOLOGICAL SOCIETY. *Secretary*, Edward C. Elsey, M.D. Meets last Monday, September to May.

CLEVELAND RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John R. Hannan, M.D., 10515 Carnegie Ave., Cleveland 6. Meetings at 6:45 P.M. on fourth Monday, October to April, inclusive.

MIAMI VALLEY RADIOLOGICAL SOCIETY. *Secretary*, Geo. A. Nicoll, M.D., Miami Valley Hospital, Dayton. Meets monthly, second Friday.

Oklahoma

OKLAHOMA STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, W. E. Brown, M.D., 21st and Xanthus, Tulsa 4. Meets in October, January, and May.

Oregon

OREGON RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, C. Todd Jessell, M.D., 224 Medical-Dental Bldg, Portland 5. Meets monthly, on the second Wednesday, at 8:00 P.M., in the library of the University of Oregon Medical School.

Pacific Northwest

PACIFIC NORTHWEST RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Sydney J. Hawley, M.D., 1320 Madison St., Seattle 4. Meets annually in May.

Pennsylvania

PENNSYLVANIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, James M. Converse, M.D., 416 Pine St., Williamsport 8. Meets annually.

PHILADELPHIA ROENTGEN RAY SOCIETY. *Secretary*, George P. Keefer, M.D., American Oncologic Hospital, Philadelphia 4. Meets first Thursday of each month at 8:00 P.M., from October to May, in Thomson Hall, College of Physicians, 21 S. 22nd St.

PITTSBURGH ROENTGEN SOCIETY. *Secretary-Treasurer*, Edwin J. Euphrat, M.D., 3500 Fifth Ave., Pittsburgh 13. Meets monthly, second Wednesday, at 6:30 P.M., October to May, at Webster Hall.

Rocky Mountain States

ROCKY MOUNTAIN RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Maurice D. Frazer, M.D., Lincoln Clinic, Lincoln, Nebr.

South Carolina

SOUTH CAROLINA X-RAY SOCIETY. *Secretary-Treasurer*, S. H. Fisher, M.D., 107 E. North St., Greenville. Meets with State Medical Association in May.

South Dakota

RADIOLOGICAL SOCIETY OF SOUTH DAKOTA. *Secretary-Treasurer*, Marianne Wallis, M.D., 1200 E. Fifth Ave., Mitchell. Meets with State Medical Society.

Tennessee

MEMPHIS ROENTGEN CLUB. Meetings second Tuesday of each month at University Center.

TENNESSEE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, J. Marsh Frère, M.D., 707 Walnut St., Chattanooga. Meets annually with State Medical Society in April.

Texas

DALLAS-FORT WORTH ROENTGEN STUDY CLUB. *Secretary*, X. R. Hyde, M.D., Medical Arts Bldg., Fort Worth 2. Meets monthly, third Monday, in Dallas odd months, Fort Worth even months.

HOUSTON X-RAY CLUB. *Secretary*, Curtis H. Burge, M.D., 3020 San Jacinto, Houston 4. Meetings fourth Monday of each month.

TEXAS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, R. P. O'Bannon, M.D., 650 Fifth Ave., Fort Worth, Next meeting, Jan. 19–20, 1951, in Galveston.

Utah

UTAH STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Angus K. Wilson, M.D., 343 S. Main St., Salt Lake City. Meets third Wednesday, January, March, May, September, November.

Virginia

VIRGINIA RADIOLOGICAL SOCIETY. *Secretary*, P. B. Parsons, M.D., Norfolk General Hospital, Norfolk.

Washington

WASHINGTON STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, R. C. Kiltz, M.D., 705 Medical-Dental Bldg., Everett. Meetings fourth Monday, October through May, at College Club, Seattle.

Wisconsin

MILWAUKEE ROENTGEN RAY SOCIETY. *Secretary-Treasurer*, Theodore J. Pfeffer, M.D., 839 N. Marshall St., Milwaukee 2. Meets monthly on second Monday at the University Club.

RADIOLOGICAL SECTION OF THE WISCONSIN STATE MEDICAL SOCIETY. *Secretary*, Abraham Melamed, M.D., 425 E. Wisconsin Ave., Milwaukee. Meets in May and with State Medical Society, September.

UNIVERSITY OF WISCONSIN RADIOLOGICAL CONFERENCE. Meets first and third Thursdays 4 P.M., September to May, Service Memorial Institute, Madison 6.

WISCONSIN RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Irving I. Cowan, M.D., 425 East Wisconsin Ave., Milwaukee 2.

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LA SOCIÉTÉ CANADIENNE-FRANÇAISE D'ELECTROLOGIE ET DE RADIOLOGIE MÉDICALES. *General Secretary*, Origène Dufresne, M.D., Institut du Radium, Montreal. Meets third Saturday each month.

CUBA

SOCIEDAD DE RADIOLOGÍA Y FISIOTERAPÍA DE CUBA. Offices in Hospital Mercedes, Havana. Meets monthly.

MEXICO

SOCIEDAD MEXICANA DE RADIOLOGÍA Y FISIOTERAPIA. *General Secretary*, Dr. Dionisio Pérez Cosío, Marsella 11, México, D. F. Meetings first Monday of each month.

PANAMA

SOCIEDAD RADIOLÓGICA PANAMEÑA. *Secretary-Editor*, Luis Arrieta Sánchez, M.D., Apartado No. 86, Panama, R. de P.

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THE HEAD AND NECK

Radiological Study of the Cerebral Cisterns in Pathologic Conditions. Guido Lombardi. Radiol. med. (Milan) **35:** 763–790, October 1949. (In Italian)

The author has had occasion to study the large amount of material gathered at the Neurologic Institute of Milan and believes that the best technic for the study of cerebral cisterns consists of a fractional filling with opportune manipulations of the head. He presents numerous pathologic cases illustrating the usefulness of the method and finds that this study is indicated in (1) arachnoiditis in the region of the optic chiasma, (2) tumors of the sella, (3) chronic communicating hydrocephalus, (4) atrophy and malformation of the cerebellum, and (5) lesions of the cerebellopontine angle.

This paper may be considered a continuation of that published in the same journal in 1947 by F. Mascherpa (Abst. in Radiology **50:** 121, 1948), from the same institution, describing the normal anatomy of the subarachnoid spaces. Both articles are well worth reading by anyone interested in neuroroentgenology.

Thirty-two roentgenograms.

CESARE GIANTURCO, M.D.
Urbana, Ill.

Angiography in Post-Traumatic Intracranial Haemorrhages. Ingmar Wickbom. Acta radiol. **32:** 249–258, Oct. 31, 1949.

The author suggests that in traumatic cases with equivocal cerebral neurological findings angiography may prove a relatively simple and effective method of locating an intracranial hematoma and determining its character. The procedure is less trying than other diagnostic methods, especially in unconscious or severely injured patients. The contrast medium usually employed is a water-soluble iodine salt, such as is used for urography. Since it is possible, however, that this material itself may cause a certain degree of deterioration in an already severely injured, edematous brain, no more than a 35 per cent solution should be used in the presence of an acute skull injury, and this in the smallest possible quantity. At the Serafimer Hospital (Stockholm), from which this report comes, the percutaneous method is practised, and a special cassette holder has been constructed to avoid the necessity of moving the patient's head for lateral films.

The more common type of intracranial hemorrhage is the subdural hematoma. In the chronic form, symptoms usually develop slowly, and the patient does not present himself for examination until several months after the trauma (which he often cannot remember). A fairly large subdural hematoma always results in a displacement of the anterior cerebral artery. If this artery lies in the midline in spite of a large subdural hematoma, it may be inferred that a hematoma is also present on the other side. Even small hematomas may be diagnosed in this way.

Acute subdural hematomas are usually more basally situated, and are generally associated with a severe cerebral contusion. With angiography, cerebral contusion accompanied by hemorrhage may be suspected when the middle cerebral artery is displaced to a much greater degree than would occur with extracerebral hematoma.

For the most part, extradural hematomas result in the same type of arteriographic picture as the subdural hematomas, with a displacement of the vessels in the vault. Extradural hematomas usually lie above the temporal lobe and as a rule appear as a result of a lesion of the middle meningeal artery. They may also be associated with contusion or hematoma in the temporal lobe. Radiologically they cannot be differentiated from subdural hematomas.

A picture of the special cassette holder and 16 excellent radiographic reproductions are included.

E. S. KEREKES, M.D
University of Arkansas

Arteriovenous Aneurysms of the Brain. Report of Ten Cases of Total Removal of the Lesion. Gösta Norlén. J. Neurosurg. **6:** 475–494, November 1949.

Eventually most, if not all, patients with arteriovenous aneurysm of the brain die of hemorrhage or are completely incapacitated. The treatment of choice is complete removal. The author reports 10 cases in which total removal was done. All patients had preoperative angiography, and in 9 angiograms were obtained after surgery.

The clinical results in 8 patients have been very good, and all have returned to full working capacity. Two patients, though showing some improvement, remain invalids. This probably is due to destruction of brain tissue from intracerebral hemorrhage prior to surgery.

The angiographic studies of the cerebral circulation indicated a rapid return to normal of vessels which before surgery were enlarged and tortuous. From the preoperative angiograms it was evident that the circulation was poor through vessels other than those entering the aneurysm. After removal of the aneurysm, circulation through these vessels was considerably greater and appeared normal.

Thirty-four roentgenograms.

HOWARD L. STEINBACH, M.D.
University of California

Transient Hemiplegia Associated with Cerebral Angiography (Diodrast). J. G. Chusid, Franklin Robinson, and M. P. Margules-Lavergne. J. Neurosurg. **6:** 466–474, November 1949.

Two cases of transient hemiplegia as an immediate complication of diodrast cerebral angiography are reported.

The first patient received two injections of 20 c.c. of 35 per cent diodrast into the right common carotid artery under local anesthesia. Thirty seconds following the second injection the patient lost consciousness, and after three minutes a complete left flaccid hemiplegia was present. Return of motor function occurred within an hour and a half, and within two and a half hours the patient was alert, oriented, and with no evidence of a speech disturbance. An electroencephalogram made two months later was normal.

The second patient received two injections of 35 per cent diodrast into the left common carotid artery, a total of 35 c.c. being used. The injections were done under local anesthesia. Following a third injection of 15 c.c. of 35 per cent diodrast, the patient became confused and dysphasic. A right flaccid hemiparesis was evident, which persisted for four days. An electro-

encephalogram taken one day after the hemiplegia indicated dysfunction over the left cerebral hemisphere.

The authors believe that these complications were due to vasospasm. Both patients had negative ocular tests for diodrast sensitivity and subsequently underwent angiographic study without incident, indicating that the phenomena probably were not due to diodrast sensitivity.

Five electroencephalograms.

HOWARD L. STEINBACH, M.D.
University of California

Metastasizing Cerebellar Tumors. The Difficulty in Distinguishing Between Medulloblastoma and Neuroblastoma. Robert P. Barden and Frederic H. Lewey. J. Neurosurg. **6:** 439–449, November 1949.

The term "medulloblast" was first used by Bailey and Cushing to designate a hypothetical immature, bipotential cell which may develop into neuroblasts or glioblasts. It is generally agreed today that there is a common tumor of childhood located primarily in the cerebellar vermis, though later extending into the hemisphere, which has been called medulloblastoma. This tumor at first is extremely radiosensitive, but eventually becomes resistant to irradiation. It occurs chiefly in children under twelve years of age, but is occasionally found in the second and third decades of life.

The tumors occurring in the older patients differ in history, prognosis, and position from those in the younger patients. The tumors in childhood are very malignant, and histologically a diffuse arrangement of immature cells is prevalent. In adults the tumors may be less malignant; whorl and strand formations with reticulin septa are more frequently present in this group; widespread metastases may develop.

The authors believe that if some of the cerebellar tumors in the older age group are considered to be neuroblastomas rather than medulloblastomas, the inconsistencies in the clinical course can be explained. They suggest, therefore, that patients with clinical evidence of a cerebellar tumor who are in the second and third decades of life should have preoperative roentgenograms of the chest, skeleton, and urinary tracts, to determine the presence of metastases or an occult primary tumor outside the central nervous system.

Three cases are reported. In one the cerebellar tumor was associated with a soft-tissue mass in the right posterior mediastinum and widespread bony metastases; in the other two, bony metastases were present.

Five roentgenograms; 6 photomicrographs.

HOWARD L. STEINBACH, M.D.
University of California

Intradiploic Epidermoid Tumors (Cholesteatoma of the Skull). Leo J. Adelstein. Am. J. Surg. **78:** 480–485, October 1949.

Epidermoid, cholesteatoma, pearly tumor, and Cruveilhier's *tumeur perlée* are synonymous terms loosely used to refer to a tumor of embryonic origin resulting from an incomplete separation of the neural from the surface ectoderm. Actually the designation cholesteatoma should be restricted to masses of ingrowing squamous epithelium in the middle and internal ear secondary to chronic infections of the mastoid. Epidermoid, on the other hand, should be the term used when speaking of the true benign neoplasms which occur either within the cranium or within the diploe as a result of an embryologic remnant of ectoderm.

A total of 41 intradiploic epidermoids have been reported in the literature, and to these the author adds 2.

The clinical and x-ray appearance of this tumor is rather typical. Usually there is a palpable defect in the normal contour of the skull. If the inner table has been eroded, transmitted pulsation of the mass may be elicited. X-ray examination reveals a defect in the bones of the skull which may or may not be regular. The margins of the defect may be scalloped or smooth.

These tumors may be removed surgically, but if all the stratified squamous epithelium of the wall is not included, there is a tendency to recurrence. If the inner table of the skull is eroded, a careful search for intracranial extension should be made.

In each of the author's cases the physical and roentgenologic findings were typical. One of the patients had suffered a head injury some seven years previously, and it was thought that some epithelial cells might have been driven into the bony tissues at that time.

Five typical roentgenograms are reproduced and 2 microscopic sections showing the stratified squamous epithelium.

JOHN W. HOPE, M.D.
University of Pennsylvania

Demonstration of Organic Disease in "Functional Illness" by Skull X-rays. Jack J. Coheen. Illinois M. J. **96:** 245–249, October 1949.

Four cases are presented in detail in which definite organic disease was found by x-ray examination of the skull in patients with mental illness which had been considered purely "functional." One patient with a paranoid schizophrenia was found to have osteoporosis circumscripta cranii. A 72-year-old female with an unclassified psychosis was shown by skull films to have extensive hyperostosis frontalis interna. A third patient had advanced Paget's disease with thickening of the skull in addition to a psychoneurosis with reactive depression. The final case was one of craniostenosis associated with psychosis.

The author does not contend that the organic diseases found on the skull films were the causes of the various psychoses but merely emphasizes that there really can be no fine line drawn between so-called "functional" and organic causes of mental illness.

Five roentgenograms. ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Extensive Ossification Defect of the Skull After Traumatic Cephalohydrocele. Hans Franke. Fortschritte a. d. Geb. d. Röntgenstrahlen **71:** 416–418, July 1949. (In German)

A 46-year-old man, apparently healthy, presented a large bone defect in the parieto-occipital region. The defect was first observed during infancy when, on two occasions, the patient fell on his head. A firm membrane covered the bone defect but pulsation was visible. There were no mental or neurological manifestations.

One roentgenogram. ERNST A. SCHMIDT, M.D.
Denver, Colo.

Plasma Cell Tumor Simulating Bilateral Maxillary Sinusitis. Morey Parkes and Samuel Burtoff. Arch. Otolaryng. **50:** 666–668, November 1949.

The case of plasma-cell tumor reported here is of particular interest in that the condition simulated

chronic maxillary sinusitis. Roentgen study of the sinuses revealed definite and profuse haziness of both antra. The remaining sinuses were essentially normal. When the patient failed to show improvement, subjectively or objectively, following several irrigations, a study of the antra was made after injection of iodized oil. Each antrum accepted only 1 c.c. of oil, and subsequent roentgenograms revealed a marked filling defect suggesting extreme polypoid degeneration or a tumor bilaterally. Biopsy disclosed only the pathologic changes typical of a nasal polyp. Microscopic examination of tissue removed at a bilateral Caldwell-Luc operation, however, revealed plasma cells. Roentgen irradiation was begun about four weeks following surgery, for a total dose of 1,500 r to each antrum and 1,500 r each to the right and left zygomatic region. Improvement was remarkable and the plasma-cell tumor tissue in the nasopharynx and in the nose itself seemed to disappear. Six months after treatment there were no signs or symptoms of the disease.

Early diagnosis is important in tumors of this type because of the efficacy of radiation. However, an overall poor prognosis may be expected, since it has been found that even after an interval of seven to ten years the neoplasm may recur as multiple myeloma in other locations.

Orbital Emphysema Following Fracture of the Nasal Sinuses. R. S. Murray. J. Faculty of Radiologists **1:** 121–130, October 1949.

Fractures of the ethmoid bone are usually overlooked, either because they are not suspected or because the ethmoid area is overexposed radiographically in order better to visualize the skull or other bones of the face. The author has observed 6 cases of fracture in the ethmoid area, each of which was associated with orbital emphysema, sharply outlining the orbit on the injured side. Only one of these cases showed clouding of the ethmoids, indicating the bleeding which is usually considered diagnostic of ethmoid fracture. The projections of the skull found to be most useful in demonstrating orbital emphysema are: occipito-oral and occipito-frontal, parieto-orbital (optic foramen), and lateral. The optic foramen view frequently demonstrates the fracture when it cannot be seen in other views. The most important finding is the bright shadow of air within the orbit, which usually sharply outlines the upper border of the globe.

All 6 cases gave a recent history of injury to the orbit and nose. The striking clinical feature was puffiness of the lid on the involved side, which increased on blowing the nose and which revealed crepitation on palpation.

Thirteen roentgenograms; 13 diagrams.

D. R. BRYANT, M.D.
The Henry Ford Hospital

THE CHEST

Contusions of the Lung from Nonpenetrating Injuries to the Thorax. W. C. Sealy. Arch. Surg. **59:** 882–887, October 1949.

The lung may be injured within the intact thorax by any force which compresses the thoracic cavity or which is transmitted through the thoracic tissues to the lung. Blast injuries, blunt blows, and glancing projectile wounds are common causes. Contusion of the lung parenchyma leads to edema or hemorrhage, which in turn may produce x-ray changes consisting of single or multiple areas of density. In the absence of secondary pneumonia, these usually clear in from two to eight days, suggesting the importance of edema in their causation. Rib fracture is not necessarily present. When it occurs, it may act to absorb the force of the injury and thus protect the lung. The most common clinical symptom is hemoptysis.

Details of 14 cases of pulmonary contusion are presented.

Eight roentgenograms; 2 tables.

LEWIS G. JACOBS, M.D.
Oakland, Calif.

Bronchiectasis in Childhood. I. Clinical Survey of 160 Cases. II. Aetiology and Pathogenesis, Including a Survey of 272 Cases of Doubtful Irreversible Bronchiectasis. III. Prophylaxis, Treatment and Progress with a Follow-up Study of 202 Cases of Established Bronchiectasis. C. Elaine Field. Pediatrics **4:** 21–46; 231–248; 355–372, July, August, and September 1949.

The author has made a study, presented in three parts, of bronchiectasis in children. The first part is a clinical survey of 160 irreversible cases confirmed bronchographically or at autopsy. The age range was up to twelve years. Less than 10 per cent of the children were under three years, probably due to the reluctance to undertake bronchography in this early age group. A majority of the cases in the first year of life were of the fulminating variety and came to autopsy.

A characteristic feature of the disease was a constant cough, with or without sputum. Because of this many of the cases had been diagnosed as chronic bronchitis. Hemoptysis was rare, but in 33 per cent of the series there were associated asthmatic symptoms. Many of the children had chest deformities, and clubbing occurred in 43.7 per cent. The latter was diagnostic of irreversibility in the cases studied by the author. Of the physical signs, the most useful for diagnosis was localized râles on deep inspiration over the suspected area of involvement. No single symptom or sign was pathognomonic, but the diagnosis was suggested rather by the clinical syndrome, which had to be evaluated individually.

Routine x-ray films proved generally unreliable unless the findings were confirmed by bronchography, which is the only procedure available for accurate diagnosis of the disease and evaluation of the type of lesion, its extent, and suitability for surgical treatment. Determination of reversibility or irreversibility is of particular importance in children. If the bronchial dilatation was greater toward the periphery than near the stem bronchus (club-shaped), the condition was considered permanent and irreversible, and therefore suitable for surgical treatment, but where the dilated bronchus was of equal diameter along its length, reversion to normal was considered possible and the child was re-examined after a year or two.

Four varieties of bronchiectasis are recognized bronchographically: tubular (53 per cent of this series); fusiform (10.6 per cent); cystic (20.6 per cent); and varicose (10 per cent); 5 per cent of the cases were indefinite. The cystic type was considered to be either congenital in origin or the sequela of a virulent infection of the lungs with destruction of the bronchial walls, especially of the smaller bronchi and bronchioles. The tubular type was frequently associated with lobar collapse and not uncommonly seen in mild forms of

asthma. The fusiform variety was rare. The varicose type was more common in the older age group, probably occurring as a less virulent infection in an older child with more resistance to damage to the bronchial walls.

The left lower lobe was most often involved (85.6 per cent), followed by the lingula and right middle lobe (65.6 per cent and 62.5 per cent, respectively). The preponderance of lower lobe involvement is discussed with particular reference to the factors of gravity and angulation contributing to inadequate drainage. Forty-six per cent of the cases revealed one or more areas of lobar collapse.

Bronchoscopy as a diagnostic and localizing aid in children was of doubtful value, as were routine blood studies. Complications were few, the commonest being pneumonia (16.3 per cent).

It was noted in the Clinical Survey (Part I) that symptoms of bronchiectasis commonly date from an attack of pneumonia or pertussis. In Part II it is pointed out that the common factor in these and other pre-bronchiectatic conditions is non-aeration of some or all of the alveoli supplied by a bronchus. While infection undoubtedly predisposes to a permanent change, the author feels that it is unproved as an essential factor. [She apparently disregards the experimental work of Tannenberg and Pinner (J. Thoracic Surg. **11:** 571, 1942) in reaching this conclusion.] On the other hand, she believes that the ensuing destruction of supporting elements and fibrosis render the wall more susceptible to pressure changes and that such changes are a determining factor in the dilatation.

In lobar pneumonia, inflammation of the bronchial wall is minimal, resolution complete, and bronchiectasis rare. However, bronchopneumonia produces destruction of the bronchial wall as well as collapse and consolidation of alveoli. With incomplete resolution, organization of the exudate results in permanent deaeration of alveoli, the essential precursor to bronchiectasis according to the author. In pertussis and asthma bronchial secretions may cause pulmonary collapse. In such instances there is probably the additional factor of bronchial spasm preventing drainage. In tuberculosis an enlarged hilar node or granulation tissue may cause lobar collapse. Foreign bodies act similarly and may remain *in situ* for years without bronchiectasis, providing the obstruction is not complete and infection is absent.

The relationship of sinus infection and bronchiectasis is also discussed. The author feels that her statistics suggest that bronchiectasis does give rise to a certain amount of antral infection. An opaque antrum was found to show mucopus on puncture more frequently in the presence of irreversible bronchiectasis than when associated with pulmonary collapse with no bronchiectasis. That sinus infection is not a necessary precursor of bronchiectasis was suggested by the absence of evidence of antral disease in about one-quarter of the known cases of irreversible bronchiectasis.

In a clinical study of 272 cases of pulmonary collapse which were followed three years or more, 157 showed re-expansion without permanent bronchiectatic changes. Of this group, 111 were considered cured, 16 were improved, and 13 revealed no significant change.

Ninety-nine cases classified as doubtful bronchiectasis when first seen were also studied. Of this group 47.5 per cent had asthma. In 40 of the 99 patients an irreversible bronchiectasis developed in the three-year period of observation.

In concluding this part of her discussion, the author stresses the importance of recognizing and adequately treating certain predisposing conditions without delay before irreversibility sets in; pneumonia, pertussis, and pulmonary collapse in particular. If a cough continues six weeks or more after an acute illness, full investigation and energetic treatment are recommended. Nasopharyngeal conditions often present in association with pulmonary infections should be treated simultaneously, since one predisposes to the other, although both can exist separately. Though more susceptible, children have a greater recuperative power with adequate treatment than adults.

In Part III the author discusses at greater length the prophylactic measures to avoid the development of an irreversible bronchiectasis. Once the condition is regarded as irreversible, there are three courses of treatment which enter into consideration: surgical or curative; medical or palliative; partial surgical removal to alleviate the symptoms. In general, radical surgery is recommended in all cases where an adequate amount of healthy lung can be preserved.

Two hundred and two cases were followed for three years or longer. Whereas occasionally under a medical regimen, clubbing disappeared, chronic chest deformities tended to persist. There was a greater tendency for dilatation to progress or remain stationary rather than to improve. There was a greater tendency for the pectoral segments of the right upper lobes to deteriorate; for the left lower lobe and lingula to remain stationary; and for the apical segment of the right upper lobe and dorsal bronchus of the left lower lobe to improve. Varicose and fusiform types of dilatation tended to improve and caused the least physical disturbance, whereas club-shaped and cystic bronchi indicated irreversibility.

Following surgery, the remaining bronchi grow in length and fill the entire hemithorax. In children, whether this is due to the formation of new alveoli (as in kittens) or to alveolar distention with increased vascularity and interalveolar tissue (as in rats) is not known. At any rate, the functional capacity of the remaining lung improves beyond expectations.

The mortality rate was unaffected by the regimen employed, although relatively twice as many cures were obtained when surgery was employed.

This paper is illustrated by a large number of roentgenograms, and numerous charts and tables set forth the observations graphically.

HARRY J. PERLBERG, JR., M.D.
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Chronic Pneumonitis: Its Clinical and Pathologic Importance. Report of Ten Cases Showing Interstitial Pneumonitis and Unusual Cholesterol Deposits. William R. Waddell, Ronald C. Sniffen, and Richard H. Sweet. J. Thoracic Surg. **18:** 707–737, October 1949.

This article consists, in the main, of the detailed accounts of 10 cases of chronic non-suppurative interstitial pneumonitis treated by surgical excision. The authors point out that the principal importance of this disease is that it may be confused with carcinoma of the lung. In 6 of these cases the preoperative diagnosis was carcinoma, but it was possible at operation to recognize the inflammatory nature of the process.

The principal symptoms were fever, cough, expectoration and hemoptysis, pleuritic pain, and weight loss. The duration of symptoms in the 10 cases was

from nine weeks to five years. All of the patients obtained prompt relief following lobectomy or pneumonectomy and returned quickly to a normal state of health.

An interesting pathological feature of the surgical specimens was the deposit within the pulmonary parenchyma of high concentrations of cholesterol and cholesterol esters.

These cases have been previously reported from the roentgenologic point of view by Robbins and Sniffen (Radiology **53:** 187, 1949).

Twenty-five illustrations, including 10 roentgenograms. HAROLD O. PETERSON, M.D.
University of Minnesota

Histoplasmin, Coccidioidin, and Tuberculin Reactions in Children with Pulmonary Calcifications in Milwaukee. Hans W. Hefke and Bruce F. Grotts. Wisconsin M. J. **48:** 927–929, October 1949.

One hundred children in Milwaukee showing pulmonary calcification radiographically, either hilar, peripheral, or both, were tested with tuberculin and histoplasmin. Ninety-three were also tested with coccidioidin. Findings were as follows: 8 per cent were both tuberculin and histoplasmin positive; 65 per cent were tuberculin positive and histoplasmin negative; 4 per cent were tuberculin negative and histoplasmin positive; 23 per cent were negative to both tuberculin and histoplasmin. Only one positive coccidioidin reaction was obtained, in a child who was positive also to histoplasmin but was tuberculin-negative. These findings indicate that histoplasmosis is infrequently and coccidioidomycosis rarely the cause of pulmonary calcification as seen roentgenologically in Wisconsin.

ZAC F. ENDRESS, M.D.
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Pulmonary Syphilis in the Adult. Eberhard Günsel. Fortschr. a. d. Geb. d. Röntgenstrahlen **71:** 407–410, July 1949. (In German)

Pulmonary syphilis is considered of rare occurrence, and the clinical and radiologic manifestations are not characteristic. Rössle is said to have reported 25 cases seen at autopsy, in none of which had the diagnosis been made during life, and in a series of 55 cases cited from Karschner only 4 were recognized before death.

Syphilis of the lung is said to appear five to ten years after infection, in the tertiary stage of the disease, and to occur chiefly in men in the fifth decade. An interstitial pneumonia with hyperplasia of connective tissue is described as the most common form. The changes in the arteries (periarteritis, mesarteritis, and endarteritis, with ultimate obliteration of the lumen), in the bronchi, and in the interalveolar septa produce marked shrinkage and cicatrization. According to Rössle, spirochetes cannot be demonstrated in histologic sections. More rarely, a circumscribed or diffuse nodular or gummatous form of pulmonary syphilis is noted, frequently accompanied by caseation but only rarely resulting in cavity formation. Calcium deposition is never observed.

Clinically the disease is characterized by its protracted course and, generally, a paucity of symptoms. Only in advanced cases, dyspnea, asthmatoid attacks, and fever may occur, the last due to stagnation of secretion or liquefaction. The bronchial changes are represented by bronchitis and peribronchitis, later by bronchiectasis with occasionally blood-tinged, putrid, or fetid sputum. Pleuritis with either pleural thickening or pleural effusion ensues; the pleural fluid is often hemorrhagic and shows a strongly positive Wassermann reaction. The right lung is predominantly involved, especially the middle third; the upper segments are as a rule unaffected.

Conditions to be differentiated are tuberculosis, bronchial carcinoma, pneumoconiosis, chronic pneumonia, and fungous disease. The syphilitic infiltrates usually respond readily to antisyphilitic treatment but it is not permissible to base the diagnosis on this therapeutic success alone, since many other infiltrative and bronchiectatic processes, as well as fungous infections, may be favorably influenced by salvarsan, bismuth, or potassium iodide.

A case is described and illustrated in which pulmonary syphilis was diagnosed in a 48-year-old man complaining of dyspnea. A large area of increased density was present in the middle and upper thirds of the left lung, combined with elevation of the left diaphragm and displacement of the heart to the left. The usual serologic tests were positive for syphilis, but no follow-up observations are given and there is no reference to the results of antisyphilitic treatment or other factors in corroboration of the diagnosis.

Three roentgenograms. ERNST A. SCHMIDT, M.D.
Denver, Colo.

Pneumoconiosis in Graphite Workers. L. Dunner and D. J. T. Bagnall. Brit. J. Radiol. **22:** 573–579, October 1949.

Though no single finding is pathognomonic of pneumoconiosis in graphite workers, the condition is best diagnosed radiographically, since it produces no symptoms until very late, when dyspnea, cough, and black sputum appear. Two types of x-ray picture in particular deserve mention: a miliary "snow-storm" pattern and sharply defined masses of varying size and opacity due to the coalescence of smaller lesions. The lung changes are gradually progressive, and instances have been observed in which change of occupation has not prevented the onset of new lesions or the enlargement of pre-existing ones.

Two cases are reported, one of which showed cavity formation in the left upper lobe, in a previously observed area of coalescent density. At necropsy the cavities were found to be cystic areas filled with black fluid. It is assumed that the cysts were formed as a result of increasing fibrosis around the localized graphite mass, with a resultant gradual limitation of blood supply and consequent colliquative necrosis in the lung in the area circumscribed by the fibrous tissue. Mechanical contraction of the fibrotic tissue would then result in the formation of a spherical cyst.

Seven roentgenograms; 2 photomicrographs.
SYDNEY J. HAWLEY, M.D.
Seattle, Wash.

Pulmonary Adenomatosis with a New Laboratory Finding. W. H. Hatfield and John E. Hill. Am. J. Roentgenol. **62:** 525–530, October 1949.

A case of pulmonary adenomatosis with antemortem diagnosis confirmed by the presence of small round or oval masses of epithelial cells in the sputum is reported. The cells were regular in size and shape and mitotic figures were not seen. These cells were present in several specimens.

This is believed to be the first time that the roentgen

diagnosis has been confirmed antemortem by means of sputum examination.

Two roentgenograms; 2 photographs; 4 photomicrographs.

ALBERT R. BENNETT, M.D.
Mt. Sinai Hospital of Cleveland

Pulmonary Arteriovenous Fistula (Varix). Review of the Literature and Report of Two Cases. Wallace M. Yater, John Finnegan, and Herbert M. Giffin. J. A. M. A. **141:** 581–589, Oct. 29, 1949.

This article is a review of 45 cases of pulmonary arteriovenous fistula, including two personal cases. These lesions are of congenital and often familial origin and are variously called angioma, cavernous hemangioma, and arteriovenous varix or aneurysm. They are probably not related to malignant hemangioma of the lung, but it is likely that all benign congenital pulmonary angiomas are of the same general nature as those observed in Rendu-Osler-Weber's disease or hereditary hemorrhagic telangiectasia. Some cases merely lack the lesions of the skin and mucous membrane or have no traceable familial incidence.

Pulmonary arteriovenous fistulae are composed of a distended thin-walled afferent artery, distended efferent veins, and an intervening lobulated vascular sac or labyrinth of distended vessels. The lesions are multiple in more than half the cases. The cavities are lined by mesothelial cells on a thin layer of connective tissue.

The age at which the diagnosis was made in the series reviewed varied from two days to fifty-six years, with an average of twenty-eight years. Symptoms may appear at any age. The lesion is more common in males. A family history was obtained in twelve of twenty of the cases where this point was mentioned.

The circulatory fault is dependent upon the amount of unoxygenated blood passing through the shunt. The presence and degree of signs and symptoms depend on the size and duration of the shunt. With large fistulae, compensatory polycythemia and consequent increase in blood volume occur, but there is usually no cardiac strain on the right ventricle due to the low blood pressure in the pulmonary circuit. The physiologic effects differ from those in peripheral arteriovenous fistula, where the heart may be enlarged, cardiac output enhanced, and blood volume increased by a proportional increase in plasma and erythrocytes, but where there is no oxyhemoglobin unsaturation or clubbing.

Symptoms and signs observed with pulmonary arteriovenous fistula were: cyanosis (33 of 36 cases), clubbing of fingers (31 of 34 cases), extracardiac bruit (26 of 29 cases), dyspnea (23 of 25 cases), polycythemia (28 of 33 cases), reduced oxygen saturation (all of 12 cases where stated). Other findings include: epistaxis, weakness, cardiac abnormality, convulsions, hemoptysis, chest pain, unconsciousness, dizziness, cerebrovascular accident, numbness, vomiting, splenomegaly, faintness.

The pulmonary murmur is usually continuous, accentuated with systole and deep inspiration, but it may be entirely diastolic. Cardiac examination is usually normal, as are the blood pressure, venous pressure, and circulation times. The radiographic finding of a lobulated opacity in the lung, connected by band-like linear or sinuous opacities with the hilus, is characteristic. Positive roentgen findings were present in 41 of 45 cases. The mass may be seen to pulsate fluoroscopically. Angiocardiograms are pathognomonic.

In the differential diageosis polycythemia rubra vera, congenital heart disease, and aneurysm of the pulmonary artery are to be considered.

Treatment consists of lobectomy or partial resection for solitary lesions, or even pneumonectomy if the lesions are widespread in one lung. Ligation of vessels alone is not satisfactory. Patients with small fistulae may be kept under observation, but pulmonary hemorrhage is an ever present threat. It was fatal in 3 of the cases reported. Cerebral thrombosis is also an important consideration, cerebral manifestations having occurred in 20 of the 45 cases. This and peripheral phlebothrombosis are complications of the polycythemia. Phlebotomy may be advised for temporary relief.

In 6 of 11 cases terminating fatally, death was due to the disease, usually as a result of pulmonary hemorrhage or brain abscess. Twenty-six patients were operated upon; of 22 in whom the outcome was known, 2 died postoperatively, 2 were improved, and 17 were cured.

Seven roentgenograms; 2 photographs; 5 tables.

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University of Michigan

The Differentiation of Mediastinal Tumour and Aneurysm: Value of Angiocardiography. Israel Steinberg and Charles T. Dotter. Brit. J. Radiol. **22:** 567–572, October 1949.

The usual criteria often fail in the differential diagnosis between mediastinal tumor and aneurysm because the aneurysm, if filled with clot, may fail to pulsate, while a tumor may show transmitted pulsation. Angiocardiography is a useful adjunct in the differentiation. Expensive special apparatus is not necessary. A standard stereo cassette changer which allows two films per injection is adequate. Four excellent illustrative cases are presented, with 12 roentgenograms.

SYDNEY J. HAWLEY, M.D.
Seattle, Wash.

Spontaneous Pleural Effusion in a Newborn Infant. David W. Cugell and Siegfried Scherl. Am. J. Dis. Child. **78:** 569–572, October 1949.

A review of the American literature of the last forty years has revealed only 10 cases of primary pleural effusion in infants under one year of age. All 10 cases were reported as spontaneous chylothorax. The case reported here is the only one known of primary pleural effusion in a newborn infant in which the effusion was non-chylous.

A physical examination fifteen hours after birth revealed severe substernal retraction on inspiration and some dullness over the right chest, and a roentgenogram showed a moderate-sized pleural effusion surrounding the right lung from base to apex. Thoracentesis on the second day of life yielded 75 c.c. of a turbid orange fluid. A second roentgenogram, following injection of air, showed a shift of the mediastinum to the left and a pneumothorax on the right side. A total of 5 chest taps were performed at about five-day intervals. Each time between 60 and 110 c.c. of a dark orange fluid was removed from the right side of the chest. After the last tap, fluid ceased to re-accumulate, and by the thirty-fifth day only moderate pleural thickening on the right was demonstrable.

At the time the first chest tap was performed, the possibility of a chylous effusion was considered, although the orange color of the fluid rendered this unlikely. The laboratory reported the presence of bile in

the first specimen, but none was found on subsequent examinations. Infection was not a factor, inasmuch as the child was practically afebrile, and repeated smears, cultures, and guinea-pig inoculations of fluid from the chest revealed no organism. There was no evidence of infection in the mother prior to delivery. The etiology of the effusion is thus purely speculative. Two remote possibilities may be considered: (1) traumatic pleurisy with effusion and (2) a concealed pneumothorax with effusion.

Three roentgenograms. HUGH A. O'NEILL, M.D.
Cleveland, Ohio

Position of the Heart in Inspiration and Epigastric Pulsation. A. Hasselwander. Fortschr. a. d. Geb. d. Röntgenstrahlen **71:** 419–427, July 1949. (In German)

Attention is called to an anatomical observation which, according to the author, has surprisingly escaped the most careful clinicians and radiologists for more than half a century or has been misinterpreted by them, namely, the descent of the *centrum tendineum*, or cordiform tendon, of the diaphragm and of the heart during deep inspiration and the consequent direct pulsation phenomena apparent in the epigastrium. The findings of the author, corroborated by a series of radiographic examinations in men and women of widely differing ages, show that the general anatomical ideas regarding the inability of the diaphragm to descend below its line of origin must be revised. As further demonstrated, the so-called "epigastric pulsation" must no longer be explained by transmitted pulsation, movements of the liver, or of other epigastric organs. In reality, it represents the direct pulsation of the heart palpable in the epigastrium. The fact that this pulsation is more frequently observed in emphysema, cardiac enlargement, and other pathologic conditions has probably contributed to its erroneous interpretation.

Six illustrations. ERNST A. SCHMIDT, M.D.
Denver, Colo.

The Roentgenographic and Angiocardiographic Aspects of (1) Aberrant Insertion of Pulmonary Veins Associated with Interatrial Septal Defect and (2) Congenital Arteriovenous Aneurysm of the Lung. Arthur Grishman, M. H. Poppel, R. S. Simpson, and M. L. Sussman. Am. J. Roentgenol. **62:** 500–508, October 1949.

Complete drainage of the pulmonary veins into the right heart is rarely compatible with life beyond infancy. The aberrant drainage of only one pulmonic vein, however, rarely produces symptoms, and until recently had not been diagnosed in a living patient. The authors report 3 cases of insertion of the right lower lobe pulmonic vein into the inferior vena cava, with similar clinical and radiographic findings. The electrocardiograms were also similar, each revealing a partial right bundle branch block, which is frequently encountered in interatrial septal defect, an anomaly which is always present with aberrant insertion of a pulmonary vein.

Only the roentgen findings distinguished these cases from uncomplicated interatrial septal defect. These were: considerable enlargement of the heart to the right; a moderate enlargement to the left; prominence of the pulmonary artery segment; a laterally convex vascular shadow parallel to the lower right cardiac border, representing the anomalous vessel. Fluoroscopically this vessel did not pulsate. The anomalies were proved by angiocardiography, but the authors believe that, once one becomes familiar with the roentgen findings, the diagnosis can be made on an ordinary postero-anterior chest film.

Three cases of arteriovenous aneurysm of the lung are also reported. Operation was done on 2 of the patients. One was found also to have an accessory pulmonary artery and the other an aberrant pulmonary vein emptying into the inferior vena cava. Such anomalous vessels are thought to be not uncommon.

The roentgen appearance of congenital arteriovenous aneurysm of the lung is rather characteristic: a serpiginous racemose structure, or coil of structures, with parallel walls which suggest vascular structures in density and outline. Pulmonary infiltration is absent but there may be some focal atelectasis. Angiocardiography is the method of choice for showing that the pulmonary shadow is due to vascular components.

Fourteen roentgenograms; 1 phonocardiographic and electrocardiographic tracing.

HARRISON SHAPIRO, M.D.
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A Case of Tetralogy of Fallot with a Patent Foramen Ovale (Pentalogy) Showing a Marked Left Ventricular Hypertrophy and Left Axis Deviation. Benjamin M. Gasul, Julius B. Richmond, and Cecil A. Krakower. J. Pediat. **35:** 413–421, October 1949.

This is the report of a case of Fallot's tetralogy plus a patent foramen ovale with left axis deviation and left ventricular hypertrophy rather than the customary right axis deviation with a normal left ventricle.

The patient was a 9-year-old white girl who had exhibited cyanosis since birth, as well as dyspnea on mild exertion. Edema of the hands and feet led to hospitalization. Clubbing of the fingers and toes was also present. The heart was enlarged, and there was a loud systolic precordial murmur. The red cell count was over 9 million and the electrocardiogram showed left axis deviation and a first-degree heart block. The P waves in leads 1 and 2 were tall, broad, and peaked. Chest films showed a greatly enlarged, boot-shaped heart with a concave pulmonic segment and enlargement of the inflow tract of the left ventricle. The right auricle also was enlarged. The shadow of the brachiocephalic vessels was widened and the aortic knob was not discernible.

Following sudden death, postmortem studies showed: cardiac enlargement with a huge right auricle; dilatation and hypertrophy of both ventricles, more marked on the left; a widely patent foramen ovale; interventricular septal defect; dextroposition of the aorta, which opened to the right of the interventricular septum rather than to the left and overrode the septal defect; stenosis of the pulmonic valve, which was bicuspid; verrucous endocarditis of the tricuspid, mitral, and aortic valves.

The major cause for confusion in diagnosis was the left axis deviation, which has been held to exclude Fallot's tetralogy.

Eight illustrations, including 3 roentgenograms.

CORNELIUS COLANGELO, M.D.
Chicago, Ill.

Congenital Aortic Septal Defect. J. H. Dadds and Clifford Hoyle. Brit. Heart J. **11:** 390–398, October 1949.

The authors found 11 cases of congenital aortic septal defect recorded in the literature since 1830. They

review these and add a further case. The defect involves the anterior wall of the aorta just above the semilunar cusps, its lower border being formed by a smooth ridge of tissue separating the aortic and pulmonary sinuses. It leads directly into the pulmonary artery. The usual size is about 1 cm. in diameter, but the defect in the authors' case measured 6 × 5 cm. That the condition is a serious threat to life is evident from the fact that only 3 patients in the series of 11 survived beyond the second decade. The authors' patient lived to the age of sixteen in spite of the large lesion.

The heart is always enlarged. In the present case there was also dilatation of the pulmonary artery, though this is not a constant finding, due probably to the frequency of small defects. The pulmonary vessels also showed engorgement.

The diagnosis has not been made during life but the authors discuss the differential diagnosis from patent ductus and atrial septal defects. It is suggested that retrograde angiocardiography might lead to a diagnosis. "It is said to outline a patent ductus very clearly, and would almost certainly show the site and size of an aortic septal defect."

Five illustrations, including 3 roentgenograms; 1 table.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Tracheo-Esophageal Constriction Produced by Right Aortic Arch and Left Ligamentum Arteriosum. Edward B. D. Neuhauser. Am. J. Roentgenol. **62:** 493–499, October 1949.

The author has observed 5 cases in which a right aortic arch, right descending aorta, and left ligamentum arteriosum encircled the esophagus and trachea, causing severe stridor and dysphagia. Roentgenologic examination showed the major mass of the aorta and aortic arch to the right of the midline and revealed an indentation of the barium-filled esophagus on the right side, best seen in the anteroposterior projection and in the left anterior oblique view. A small defect was seen also on the posterior aspect of the esophagus, produced by the ligamentum arteriosum as it passed behind the esophagus from the left side. Bronchography revealed a shallow extrinsic pressure defect on the right side of the trachea. Surgical division of the ductus was performed, with relief of the symptoms.

The cases presented are exceptions to Edwards' generalization that the ductus arteriosus lies on the same side as the upper portion of the descending aorta (Proc. Staff Meet., Mayo Clinic **23:** 108, 1948).

The anomaly most apt to be confused with this picture is the double aortic arch, particularly when the posterior or right arch passing behind the esophagus is the smaller of the two. By careful roentgenologic examination the author believes that the two conditions can be differentiated.

Thirteen roentgenograms; 2 drawings.

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THE DIGESTIVE SYSTEM

Congenital Anomalies of the Esophagus Related to Esophageal Foreign Bodies. Paul H. Holinger, Kenneth C. Johnston, and Joseph Greengard. Am. J. Dis. Child. **78:** 467–476, October 1949.

Congenital anomalies of the esophagus other than complete atresia are apparently less well known and understood than the latter condition, but they undoubtedly occur more frequently than is generally recognized. They manifest their presence by signs and symptoms of dysphagia, often insidious and slowly progressive but occasionally dramatically apparent as a foreign body becomes lodged in the lesion to produce sudden partial or complete obstruction. In such instances, the episode of the foreign body assumes major importance and the underlying congenital stenosis may not be recognized. Six cases of lodgment of a foreign body in the esophagus as the result of a congenital anomaly are presented in this paper.

There are three types of congenital esophageal lesions: (1) the congenitally short esophagus, (2) congenital esophageal stenosis, and (3) stricture of the esophagus following repair of a congenital esophageal atresia. All are illustrated in the series reported.

Children of any age may swallow food or non-edible objects which will become lodged in the esophagus. The commonest site of lodgment is the cervical portion, where the esophagus normally reaches its narrowest point. The strong muscles of the hypopharynx will carry the object to this point, but the weaker esophageal muscles may fail to carry it on its course. If the esophagus is normal and the foreign body has passed this narrow point safely, it may be considered as a general rule that it should continue into the stomach without arrest. Since the cervical portion is so frequently the site of lodgment in the normal esophagus, further roentgen study after removal of a foreign body at this site is not usually necessary. If, on the other hand, the roentgenogram shows an object lodged elsewhere, careful roentgenologic studies of the entire esophagus should be carried out to determine whether some anomaly, congenital or acquired, is responsible.

Eleven roentgenograms.

HUGH A. O'NEILL, M.D.
Cleveland, Ohio

Clinical and Roentgenologic Aspects of Esophageal Lesions in Scleroderma. Report of Six Cases. Anthony M. Kaisch. Am. J. Digest. Dis. **16:** 405–412, November 1949.

Scleroderma is a relatively rare disease, of unknown cause, producing an induration and inflammation of the skin. It generally runs a chronic course, but cases have been known to terminate fatally in a few weeks. It may occur at any age, and is more common in women than in men. Arthritic changes usually develop, and these and the thickening and induration of the skin frequently lead the patient to minimize other manifestations such as dysphagia and mild gastric distress.

The purpose of the present report is to record 6 cases with esophageal involvement. The symptoms in these patients were epigastric distress, dysphagia, and retrosternal pain. Roentgenologically, the appearance of the esophagus conforms to several patterns. There may be diffuse dilatation of the entire organ, or dilatation may occur proximal to an area of stricture. In some cases spasm may involve a large part of the esophagus, with dilatation above and below the spastic area. Extensive areas of spasm and induration may cause the barium to course through the esophagus in a spiral manner, or the esophagus may assume a saw-tooth appearance. In all cases in which the esophagus is affected by scleroderma, peristalsis is much diminished or entirely absent. There is no delay at the cardia. The esophagus, which has lost its normal pliability, remains gaping after the barium has passed through it.

As a rule, the patent organ contains a large amount of air, and localized collections of barium may be seen, which probably represent areas of ulceration.

Scleroderma of the esophagus may be confused with phrenic ampulla or cardiospasm. In phrenic ampulla the stricture moves along and is most prominent during the phase of regurgitation with the patient in deep inspiration, whereas in scleroderma the stricture is constant. Cardiospasm is differentiated from scleroderma of the esophagus by the fact that the narrowing is at the hiatus, while in scleroderma it is usually above this point. Furthermore, in scleroderma the esophagus seldom assumes the tremendous proportions seen in cardiospasm. In rare cases sclerodermatous ulcers of the esophagus may simulate primary peptic ulcer of the organ. Collections of gas may produce filling defects that resemble carcinoma. In general, however, the differentiation of these conditions is not difficult if the primary disease is kept in mind.

Five roentgenograms; 5 diagrammatic drawings.

JOSEPH T. DANZER, M.D.
Oil City, Penna.

The Effect of Dibutoline on the Motility of the Stomach and Small Intestine in Man—An X-Ray Study. Frank C. Bone, M. Bruce Crow, Donald P. White, and Julian M. Ruffin. Gastroenterology **13:** 443–450, November 1949.

It has been shown that dibutoline (dibutylurethan of dimethylethyl B-hydroxyethyl ammonium sulfate) has a marked parasympatholytic effect. It blocks the usual response to acetylcholine at the effector cells innervated by post-ganglionic nerves and also has a direct inhibitory action on non-striated muscle. It has been demonstrated to relax the iris constrictor and ciliary muscles, to inhibit the submaxillary gland, and to relax smooth muscle in arterioles and in the gastrointestinal, biliary, and urinary tracts.

The authors report a roentgen study of the effects of the drug on gastric and intestinal motility in 10 subjects without evidence of disease of the digestive tract. The esophagus, stomach, and small intestine were examined by fluoroscopy and roentgenograms at the time of ingestion of barium and at intervals of one, two, four, and six hours thereafter. This procedure was repeated in each case when the patient was receiving dibutoline subcutaneously, in dosages from 10 mg. every four hours to 25 mg. every hour; the number of doses varied from 4 to 30. There was no observed effect on the esophagus in any of the patients. The motility of the stomach and small bowel, however, was profoundly altered. The stomach showed marked diminution in peristaltic activity, but in no case was peristalsis completely abolished. There was no dilatation or change in the general contour of the stomach, which appeared to be at rest, with preservation of normal tonus. After large doses there was a marked delay in emptying. In the intestine, also, there was decreased peristalsis and a prolongation of the transit time, but changes in the mucosal pattern were unaffected.

The more marked effects, as demonstrated radiologically, are thought to represent almost complete block of parasympathetic stimulation.

The authors refer to the studies of Holt *et al.* (Radiology **49:** 603, 1947) with tetraethylammonium, pointing out that this drug gives a complete block of both sympathetic and parasympathetic impulses at the ganglia, resulting in complete cessation of all intestinal movements. The ideal parasympatholytic drug should have an immediate effect, prolonged action, and minimal side-reactions. The effect of dibutoline is immediate but transient; the side-reactions are minimal. Unfortunately it is not effective when given by mouth in the doses thus far employed.

Twenty-two roentgenograms.

S. F. THOMAS, M.D.
Palo Alto, Calif.

Experimental Observations on Cardiospasm in Man. Stewart Wolf and Thomas P. Almy. Gastroenterology **13:** 401–421, November 1949.

The opening sentence of this paper characterizes the substance of the whole report: "It has repeatedly been demonstrated that the various levels of the gastrointestinal tract participate in protective bodily reactions to a variety of noxious stimuli, including emotionally charged situations." The observations reported here have to do with esophageal function, and in particular with cardiospasm.

Fourteen subjects were selected at random from a group of patients who complained that swallowed food seemed to stick in the retrosternal region. In each instance obstruction to the flow of barium into the stomach was demonstrated by x-ray. These patients were compared with 20 asymptomatic subjects. A barium mixture was given in "mouthfuls" of 30 c.c., and the time that it took to get from the mouth into the stomach was noted. Repeated studies were made of each patient from week to week, under a variety of circumstances. That the cardiac sphincter closes down in chronic emotional stress, as well as in acute emotional stress, is illustrated by the cases reported and the accompanying films.

The authors' conclusions read as follows: "It was found that the esophageal obstruction of cardiospasm was often associated with marked hypermotility of the lower two-thirds of the esophagus. Irregular contractile activity was noted even in the presence of moderate dilatation of the organ. Only when the esophagus was widely dilated and greatly elongated was the motility absent. The degree of esophageal obstruction in 9 of 14 subjects with cardiospasm could also be intensified by increase in the contractile state of the diaphragm, as in a deep breath.

"Exacerbations or remission of symptoms in these subjects could be correlated with periods in their lives of stress, on the one hand, or relative security on the other. Moreover, in short term experimental observations, it was noted that a discussion of emotionally charged topics was associated with hypermotility and obstruction in the esophagus, while relative security and relaxation were associated with diminution or disappearance of the phenomena of cardiospasm. In a normal subject, the esophageal changes of cardiospasm were induced by the application of local noxious stimuli in the form of heat, cold, and a chemical irritant. Among other normal subjects, a few reacted with cardiospasm to general threats and stresses including symbolic ones. These data lead to the inference that cardiospasm may occur as part of a biologic reaction to stress, functional and reversible in its early stages."

Eighteen roentgenograms; 4 diagrammatic drawings; 1 table.

S. F. THOMAS, M.D.
Palo Alto, Calif.

Prolapse of Gastric Mucosa through the Pylorus, a Poorly Known Syndrome, and Its Radiologic Aspect. P. Wellens and G. Spyckerelle. J. belge de radiol. **32:** 157–169, 1949. (In French)

Since 1911 when prolapse of the gastric mucosa through the pylorus was first described, only 69 cases have been reported and the impression has been given that the condition is unusual. It is being seen, however, with increasing frequency, and the present authors estimate that it is present in almost 5 per cent of all stomach examinations they perform.

The etiology is not definitely known, but Golden's theory appears the most plausible; he attributes prolapse to an increased motility of the gastric mucosa in the antral and prepyloric regions. In systemic disorders tending toward edema, such as cardiac disease, the edematous gastric mucosa is also more liable to prolapse.

The disease can practically never be diagnosed from the symptoms alone, and the physical examination is not contributory except in the rare instances where a pyloric mass has been palpated. Gastric analysis and gastroscopy are of no value. The diagnosis must be made roentgenologically. The prolapse is seen both fluoroscopically and radiographically as a filling defect in the base of the duodenal bulb. The defect is of variable size depending on the degree of prolapse; usually the gastric mucosal folds are visible in the prolapsed tissue.

The differential diagnosis must consider and exclude duodenal ulcer, duodenitis, pedicled gastric polyps which have protruded through the pylorus, duodenal polyps and papillomata, hypertrophy of the pyloric sphincter, hypertrophic gastritis, and adhesions distorting the pylorus and duodenum.

The usual complications of gastric mucosal prolapse are repeated hemorrhages with secondary anemia, gastric retention, and coexisting gastric or duodenal ulcer.

The treatment resolves itself into a bland diet for the mild cases and surgery for the severe and complicated cases.

Twenty-three roentgenograms.

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Prolapse of Gastric Mucosa Through the Pylorus. Presentation of a Case with Severe Hemorrhage. A. E. Moon, Sr., and Terrell Speed. South. M. J. **42:** 839–844, October 1949.

The authors give a brief review of the literature on prolapse of gastric mucosa through the pylorus. A total of 49 cases are said to have been reported up to a recent date. [Others have found a larger number. See preceding abstract.—Ed.] Another is presented.

The etiology of this condition is not definitely known, but probably varies with the individual case. Symptoms are usually vague, consisting of some form of digestive upset or discomfort associated with taking of food. Nausea and vomiting, hematemesis, and melena may be encountered. Relief is not consistently obtained by diet or medication.

Diagnosis is primarily the responsibility of the roentgenologist, and is usually made only after repeated observation. The x-ray pattern is variable, but one ordinarily sees a central filling defect, circular or irregularly circular ("cauliflower") in appearance, at the base of the bulb. The nature of this pattern is very changeable, and the fluoroscopist may actually see loose mucosa passing through the pyloric canal. Gastric analysis is of no value in differential diagnosis. Tarry stools are suggestive if other sources of bleeding have been ruled out.

Treatment is surgical in cases not responding to conservative therapy consisting of bland diet, small frequent feedings, elimination of tobacco, alcohol, and caffeine, and administration of sedatives where indicated. Transfusions may be necessary where blood loss has been severe. The usual surgical procedure is antral incision, removal of the prolapsed mucosa, and some form of pyloroplasty. In severe cases subtotal gastric resection may be done.

The case reported here was characterized by severe hemorrhage, with frequent tarry stools. Twenty-one blood transfusions were required during the course of the patient's illness. X-ray examination, at first negative, eventually showed an invagination of the gastric mucosa into the base of the duodenal cap. Gastric resection was done, with good results.

Three roentgenograms.

HARVEY J. THOMPSON, JR., M.D.
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Early and Delayed Clinical Effects of Vagotomy for Peptic Ulcer. Charles S. Kipen and G. Arnold Stevens. Arch. Surg. **59:** 814–824, October 1949.

Vagus resection was done on 42 patients from twenty to sixty-eight years of age in one year in a Veterans Administration hospital. The indications were (1) chronicity, with poor response or inability to carry out an adequate regime, (2) hemorrhage, and (3) obstruction. Fourteen patients had gastro-enterostomy in addition to vagotomy, and 6 had partial gastrectomy.

Early postoperative studies showed relief of pain in 39 patients; the other 2 were overt psychoneurotics with x-ray evidence of healing of the crater, so that pain relief was difficult to evaluate. Troublesome symptoms, such as impaired gastric motility, occurred in half the series following operation. Gastric acidity was significantly decreased. Immediate postoperative x-ray studies were made in 24 cases. Healing of the crater was demonstrable in 7 of 12 patients who had not undergone gastrectomy, and six-hour retention was demonstrated in 7 of 9 patients treated by vagotomy alone.

Re-examination after three or more months was possible in 25 patients. Ten of these had been treated by vagotomy alone, 11 by vagotomy plus some supplementary procedure, and 4 had vagotomy for marginal ulcer. Roentgen study in 9 of the 10 showed six-hour retention in 7; of the whole group, 21 had roentgen study, with 11 showing retention. Of the 10, 6 had gastric acidity studies, all showing a decrease; 1 patient had died at another institution, with an autopsy diagnosis of carcinoma of the stomach; this was missed because the vagotomy was done by the transthoracic route without abdominal exploration. The other 9 had relief of pain, but 3 had symptoms referable to gastric atony; 2 of these had nevertheless gained weight. Only 2 were dissatisfied with the result. Of the 11 patients treated by combined procedures, all reported notable improvement. Of the 4 treated for marginal ulcer, all were improved. Thus 85 per cent of this series had good subjective results, but 75 per cent showed decided gastric retention.

The use of the abdominal approach is suggested to

prevent mistakes such as the failure to recognize a carcinoma noted above.

Seven tables.

LEWIS G. JACOBS, M.D.
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The Small Bowel Enema. W. Edward French. Am. J. Surg. **78:** 507–509, October 1949.

Schatzki, who first used the term "small intestinal enema" to designate the introduction of barium into the small bowel through a duodenal tube, has outlined the advantages of the procedure (Am. J. Roentgenol. **50:** 743, 1943. Abst. in Radiology **43:** 94, 1944). The author reports 3 cases of small bowel lesions without complete obstruction which were examined by the use of the Miller-Abbott tube. In each of the patients routine barium studies of the upper and lower gastro-intestinal tract were unrevealing, but the small bowel enema pointed to the site of the disease. It is concluded that this procedure should be employed in patients with gastro-intestinal complaints in whom routine studies fail to establish a diagnosis.

ROBERT J. AYELLA, M.D.
University of Pennsylvania

Management of Rupture of the Duodenum Due to Violence. Vinton E. Siler. Am. J. Surg. **78:** 715–728, November 1949.

The author confines his discussion of duodenal rupture to those injuries which he terms "subcutaneous," that is in which there is no penetration of the abdominal cavity. Counseller and McCormack, in 1,183 subcutaneous ruptures of the intestine from non-penetrating injuries, found 113, or about 10 percent, to be ruptures of the duodenum. The author points out that this condition is more common than one might be led to believe.

A history of trauma to the abdomen by blunt force, regardless of the type, should direct attention of the clinician to this form of injury. Automobile accidents in which the patient is thrown against the steering wheel are an example. The physical findings usually include those of peritoneal irritation. Pain is either diffuse or localized, as in the retroperitoneal type of rupture. There may be abdominal rigidity, nausea and vomiting, hypoactive peristalsis, obliteration of liver dullness, testicular pain on the right, air in the pelvis, and evidence of an intra- or extraperitoneal abscess. The white blood count is elevated and there are signs of peripheral circulatory collapse.

X-ray examination may be most helpful. The author does not hesitate to use either barium or lipiodol to visualize the defect. In intraperitoneal rupture of the duodenum, a definite sinus may be visualized and the diagnosis may be demonstrated clearly. In the case of extraperitoneal rupture, a roentgenogram taken either in the oblique or lateral position may reveal a sinus leading from the duodenal lumen to the retroperitoneal space. Preliminary films of the abdomen may demonstrate a pneumoperitoneum, suggesting the possibility of a ruptured hollow viscus. Collection of air about the right kidney usually suggests extraperitoneal rupture of the duodenum.

Treatment consists of measures to combat shock, chemotherapy, and other supportive therapy. When the patient is in suitable condition, he is taken to the operating room and the defect is repaired and the area drained.

The author reports 4 cases, 2 of which were diagnosed preoperatively. One case was thought to be an acute appendicitis, and another a carcinoma of the ascending colon, due to adhesions from the retroperitoneal abscess.

Three roentgenograms; 8 drawings.

A. EDWARD O'HARA, M.D.
University of Pennsylvania

Congenital Stenosis of the Jejunum. Report of a Case with Operative Recovery. W. Y. Wu and L. C. Chu. Chinese M. J. **67:** 527–530, October 1949.

A case of congenital stenosis of the jejunum in a 24-day-old infant is reported. The baby was brought to the hospital because of vomiting after almost every feeding since the second day of life. Roentgen examination after a barium meal revealed evidence of stenosis in the upper part of the jejunum. Operation was performed immediately, and recovery ensued.

Two roentgenograms.

Sarcoma of the Small Intestine. Roy Astley. J. Faculty of Radiologists **1:** 136–139, October 1949.

Two cases of sarcoma of the small intestine are presented. In the first patient, a boy 6 years of age, no symptoms referable to the intestinal tract were noted. The child lost his appetite and was listless, pale, and tired. Barium studies demonstrated a large mass containing a partially air-filled cavity communicating with the small intestine. Extensive lymphosarcoma of the ileum was found at autopsy, six weeks later.

The second patient, a boy of 12, gave a three-weeks history of recurrent, severe, left-sided abdominal pain. X-ray examination demonstrated low small intestinal obstruction. At surgery an area of intussusception was found, beginning four feet above the ileocecal valve and extending half way along the ascending colon. An intraluminal lymphosarcoma of the ileum was found to be the cause of the obstruction.

These 2 cases demonstrate the marked contrast in symptoms that can occur from lymphosarcoma of the intestine.

Six roentgenograms.

D. R. BRYANT, M.D.
The Henry Ford Hospital

Roentgen Diagnosis of Volvulus. M. Carstens. Fortschr. a. d. Geb. d. Röntgenstrahlen **71:** 450–454, July 1949. (In German)

Analyzing his observations in 8 cases of volvulus confirmed by operation, the author summarizes his conclusions as follows:

"(1) Volvulus of the small intestines cannot be diagnosed definitely; even the x-ray examination cannot lead to more than the general diagnosis of an ileus of the small intestine.

"(2) Ileocecal volvulus can be diagnosed with great probability by means of a general abdominal x-ray survey and a barium enema. The picture is one of gas-filled intestinal loops including the colon, which can always be recognized by its haustrations. The barium fills the larger part of the colon without difficulty. The high, smoothly outlined end of the barium contrast filling is of special importance. Its shape depends on the conditions of intestinal rotation. The position of the dilated intestinal loops, and the number and heights of the fluid levels are meaningless. The only differential diagnostic difficulties may be caused by highly located circular carcinomas which, however, can be excluded in most cases by the history.

"(3) Pathognomonic for volvulus of the sigmoid are the position of the dilated sigmoidal loop, the sausage shape of its ends (most easily recognizable in the Trendelenburg position) and finally, also, the smoothly outlined end of the contrast barium enema filling."

The possibility of correcting the stenosis in volvulus of the sigmoid by means of an intestinal tube under fluoroscopic guidance and so preventing the necessity of operation in acute cases is emphasized.

Two drawings. ERNST A. SCHMIDT, M.D.
Denver, Colo.

Chronic Intestinal Invagination in the Adult. Carlos Reussi. Prensa méd. argent. **36:** 2268–2273, Nov. 4, 1949. (In Spanish)

Intestinal invagination consists in the introduction of an intestinal segment into the neighboring segment either preceding or following it. An acute lesion is common in children. In adults the condition is more chronic, being measured in weeks, months, or years.

Two clinical forms are recognized: the primary, continuous chronic form, and the recurring, intermittent chronic form. The invagination may be simple or complex and may be anterograde (descending) or retrograde (ascending). A mixed type also occurs. The lesion may be further classified as ileal, ileocecal, or colonic. Ileal invagination may be subdivided into ileoileal, ileoileocolic, and ileoileocecocolic. The ileocecal variety includes cecocolic and ileocecocolic. The colonic invagination may involve any part of the colon.

The symptoms are always those of intestinal obstruction, with the presence of blood in the stools. The radiologic findings may be grouped as those recognized by direct examination of the abdomen, those obtained by roentgenographic examination after the ingestion of the opaque meal, and those obtained after an opaque enema.

The direct examination done in the supine, erect, and lateral positions shows almost always signs of intestinal obstruction—gaseous distention and fluid and gas levels—present five or six hours after the onset of the clinical syndrome. It should be recalled that there are cases in which the complete absence of gas on the right side may be a diagnostic sign of invagination.

After the opaque meal one observes "colonization" of the ileum, the latter achieving the diameter of the colon, containing an opaque mixture of gases and liquid. Other signs are apparent absence of the cecum, apparent emptying of the terminal ileum into the tip of the cecum rather than laterally into the cecum, and an accordion or pleating image of the ileum.

The opaque enema study gives characteristic findings, showing a semilunar, concave or tube-like filling-defect in the invaded segment. Shortening of the colon has been emphasized by Malenchini and Roca. The characteristic shadow may vary from case to case or at different observations of the same case.

It should be possible to make a clinical or clinicoradiologic diagnosis of intestinal invagination, after a complete examination is carried out. Furthermore, the type of invagination, its reducibility or irreducibility, and indications for treatment may also be deduced from the complete roentgenologic and clinical examination.

Fourteen roentgenograms; 1 table.
JAMES T. CASE, M.D.
Chicago, Ill.

Granulomas of the Ileocecal Region Secondary to Appendicitis (Ligneous Cecitis) Which Simulate Neoplasms. James W. Wilson, Malcolm B. Dockerty, John M. Waugh, and J. Arnold Bargen. Arch. Surg. **59:** 933–956, October 1949.

This study was prompted by the occasional observation of specimens of the right part of the colon in cases which had been surgically diagnosed as carcinoma of the cecum but which on pathologic examination proved to be merely inflammatory reactions about a diseased appendix. Most of the lesions in a series of 20 such cases were caused by perforation of the appendix; 2 followed incomplete removal of the appendix, and 1 resulted from an excessive amount of non-absorbable suture material. The appendix was usually located in the ileocecal angle, retrocecally, or retroileally, permitting rapid sealing off of the appendiceal inflammation, with the formation of a tumor consisting of large amounts of avascular fibrous inflammatory tissue. These factors account for the relatively mild symptoms.

The chief symptom was recurrent attacks of midabdominal pain with localization in the right lower quadrant. The only consistent physical finding was an abdominal mass, moderately tender in about half the patients.

Roentgenologic study shows an extracecal, extraileal mass separating the terminal ileum from the cecal head, and displacing the latter to the right. There is frequently a smooth, convex indentation on the medial side of the cecum. The mucosal pattern is normal, in contrast to what is found in the presence of a neoplasm. Since a very complete visualization is necessary to determine these points, the combination of a motor meal and barium enema may be indicated in the absence of obstruction.

Accurate preoperative diagnosis is difficult, especially the exclusion of carcinoma of the cecum. However, the mere size of a lesion should not lead to refusal of operation, since it may be one of these benign granulomas. Appendectomy leads to cure when the appendix can be identified as the source of the trouble. Otherwise a two-stage resection is recommended. Of the series reported, 17 were cured, 1 developed a chronic pelvic abscess with fistulae, and 2 (subjected to a one-stage resection) died of peritonitis.

One roentgenogram; 1 photograph; 4 photomicrographs; 3 tables. LEWIS G. JACOBS, M.D.
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Radiological Investigation of Pancreatic Disease. R. A. Kemp Harper. J. Faculty of Radiologists **1:** 75–86, October 1949.

Disease of the pancreas is more frequent than is usually realized and should always be kept in mind in patients with equivocal upper abdominal symptoms. For this reason the author has attempted to present the clinical and radiographic findings in various pancreatic conditions, including acute and chronic pancreatitis, fibrocystic disease of the pancreas, pancreatic calculi, pancreatic cysts, and carcinoma.

Radiological examination of the pancreas is carried out almost entirely by indirect means, involving a study of the position and shape of neighboring structures. The full technic of examination is outlined as follows:

1. Preliminary films, both anteroposterior and lateral, of the upper abdomen.

2. Radiography of the chest and diaphragm, as the diaphragm may be interfered with in acute pancreatitis and carcinoma.
3. A barium meal to demonstrate gastric or duodenal deformity, displacement, or invasion.
4. Barium enema to exclude deformity or invasion of the transverse colon.
5. Intravenous pyelography to define the left kidney in relation to a mass in the upper abdomen.
6. Lateral radiography of the stomach after inflation with air, to demonstrate widening of the space between the vertebrae and the gastric lumen.

Eighteen roentgenograms; 2 sets of diagrams.

D. R. BRYANT, M.D.
The Henry Ford Hospital

Contribution to the Roentgen Diagnosis of Primary Tumors and Non-Parasitic Cysts of the Liver in Children. V. Stašek. Acta radiol. et cancerol. bohemoslov. **4:** 48–56, 1949. (In French)

Non-parasitic cysts of the liver frequently occur at the lower pole; malignant lesions may be of the nodular or the diffuse form, and the roentgen picture varies accordingly. Cirrhosis, enlargement of the spleen, and varices of the cardia, so often seen in malignant disease of the liver in adults, are not encountered in children.

Four cases are presented in patients from nine months to four years of age. In each instance a shadow projected downward from the liver. Cholecystography, urography, and gastro-intestinal examination are aids to diagnosis in such cases. Displacement of the stomach, duodenum, jejunum, and colon are noted. In 2 patients the right kidney was displaced.

In 3 cases histologic study after biopsy revealed a non-parasitic cyst, a hepatocellular adenoma, and an alveolar sarcoma. In the fourth case biopsy was not done.

Seven roentgenograms.

CHARLES NICE, M.D.
University of Minnesota

Tumors of the Biliary Tract Based on 6 Years of Biliary Surgery Combined with Cholangiographic Exploration. Atilio J. Lasala. Prensa méd. argent. **36:** 2136–2141 Oct. 21, 1949. (In Spanish)

Six hundred and forty operations on the biliary tract have been reviewed from the service of Dr. Ricardo F. Finochietto. Operative cholangiography was employed for the period of six years covered by these operations. Actually cancer was observed in 64 cases, or 10 per cent, including cancer of the papilla but not including cancer frankly localized to the head of the pancreas. This high percentage of malignant tumors is probably explained by the fact that the surgical survey was one especially devoted to grave lesions of the biliary passages, particularly with the syndrome of common duct obstruction. The malignant tumors were nearly all carcinoma; sarcoma was very rare.

Among the 64 cases were 29 carcinomas of the gallbladder, 17 of which were associated with cholelithiasis (60 per cent). All were adenocarcinomas; papillary carcinoma is much less common. The distribution of carcinoma of the gallbladder is typical; the majority are very malignant, growing rapidly and early invading the liver and neighboring peritoneum. Only 5 of the 29 cases in this series were limited to the gallbladder, without invasion of the liver and common duct and without icterus. Occasionally, also, metastatic nodes were found in the neck. Four patients suffered from acute cholecystitis, with neoplastic abscess of the gallbladder. Invasion of the duodenum and colon was frequent. Diagnosis is rarely made before operation. One can only suspect the lesion. The prognosis is poor, and the only treatment is operative.

Tumors of the bile ducts and the papilla, without participation of the gallbladder, are relatively common. The primary lesion is generally located at the junction of the cystic and common duct. The most usual type is an infiltrating annular lesion, producing a firm stenosis. The clinical picture depends on the size and localization of the lesion.

Five illustrations, including 3 roentgenograms.

JAMES T. CASE, M.D.
Chicago, Ill.

Radiologic Picture of Tumor of the Gallbladder. Two Cases. Giuseppe Boriani. Radiol. med. (Milan) **35:** 808–811, October 1949. (In Italian)

The author has had occasion to study two cases of carcinoma of the gallbladder with large and bizarre shadows due to calcium cholesterol stones of unusual size and shape. He points out that such unusual calcifications should give rise to the suspicion of carcinoma.

Three roentgenograms.

CESARE GIANTURCO, M.D.
Urbana, Ill.

Cholecystitis. Adolph Kraft and William Wolf. Illinois M. J. **96:** 249–252, October 1949.

Two hundred and ten patients with cholecystitis associated with cholelithiasis underwent cholecystectomy in a two-year period. The transverse incision was used in 131 cases, and the rectus splitting incision in the remaining 79. All incisions were closed with an interrupted technic.

In all cases roentgen studies were made prior to surgery. Stones were revealed in 140 cases, in 2 of which there was spontaneous passage of gallstones from the gallbladder and cystic duct before operation. Fifty-one cases showed a non-functioning gallbladder on roentgen examination, and 11 impaired function. In 9 cases the roentgen appearance was normal but stones were found in 7 of this group, and in 2 chronic cholecystitis without stones.

The authors believe that surgical removal after proper preparation is the best treatment for both chronic and acute cholecystitis. Drainage is reserved for cases with severe complications. Three patients were found to have associated chronic pancreatitis, which improved following common duct drainage.

Various causes of the "post-cholecystectomy syndrome" are discussed, the authors being of the opinion that any of them may produce the same symptoms. They are: (1) stones in the hepatic or common duct, (2) development of a neuroma in the ligated nerve plexuses around the stump of the cystic duct; (3) leaving too large a segment of cystic duct, in which stones later form; (4) damage and stricture formation in the common duct by removal of too much of the duct; (5) organization of a hematoma at the operative site, forming duodenal adhesions.

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Pontiac, Mich.

Pneumatosis Cystoides of the Gallbladder. V. Šváb. Acta radiol. et cancerol. bohemoslov. **4:** 65–71, 1949. (In French)

A 58-year-old man had a sudden onset of right subcostal pain, nausea, and vomiting ten days previous to his admission to the hospital. Upon cholecystographic examination the gallbladder failed to show concentration of the dye. The intrahepatic efferent bile ducts were filled with gas, and small gas bubbles were present, the site and arrangement of which suggested the presence of several layers of gas in the gallbladder wall. In addition, there were several larger translucencies suggestive of extra-intestinal gas under the liver. The condition subsided spontaneously. Non-filling of the gallbladder persisted.

In the presence of findings of the type described emphysematous pericholecystitis and enterocolic fistula must be considered in the differential diagnosis.

Four roentgenograms. CHARLES NICE, M.D.
University of Minnesota

Problem of the Remaining Common Duct Stone. Ralph V. Byrne. Am. J. Surg. **78:** 514–517, October 1949.

A case is reported in which a routine cholangiogram following choledochotomy and cholecystectomy disclosed three stones still in the common duct. With the use of a biliary flush the stones passed into the duodenum and were recovered from the stool. The two methods of non-operative treatment of remaining common duct stones are discussed, with their disadvantages and merits. Operative and postoperative cholangiography is advocated as a routine.

Two roentgenograms; 1 photograph of specimen.
ALLAN K. BRINEY, M.D.
University of Pennsylvania

Cholangiography Through Biliary Fistulae. With Report of Two Cases. V. E. Johnson, L. S. Ellenbogen, and J. A. Gruhler. J. M. Soc. New Jersey **46:** 477–480, October 1949.

Cholangiography is usually performed by injecting opaque material through a T tube left in the common duct following some type of biliary surgery for the purpose of determining the patency of the common bile duct. It can be done also by inserting a catheter into an external biliary fistula and injecting a contrast substance. Two such cases are here reported. One patient had a fistula caused by a stricture at the sphincter of Oddi. In the other a cholecystostomy had been done with removal of stones and drainage of the gallbladder; jaundice later developed and cholangiography revealed a stone in the common duct. In this latter case the gallbladder and the fistulous tracts filled upon injection, but the ducts were not well seen until a fatty meal was given to contract the gallbladder.

Three roentgenograms. ZAC F. ENDRESS, M.D.
Pontiac, Mich.

THE MUSCULOSKELETAL SYSTEM

Difficulties of Differential Diagnosis Between Primary Tumor and Inflammatory Conditions of Bone. Radiologic Study. Bruno Perotti. Radiol. med. (Milan) **35:** 790–808, October 1949. (In Italian)

The author presents several cases which were observed at the Tumor Institute of the University of Milan in which the differential diagnosis rested between neoplastic and inflammatory conditions. He concludes that it is often impossible to arrive at a definite diagnosis from the radiographs alone and that these must be considered a part of the general study of the patient along with the clinical history and the pathological reports.

Nineteen roentgenograms; 2 drawings.
CESARE GIANTURCO, M.D.
Urbana, Ill.

Melorheostosis. A Case With Monomelic Distribution. George S. Boyer and H. Milton Berg. Minnesota Med. **32:** 979–985, October 1949.

Melorheostosis is a rather rare form of osteosclerosis in which the bones present a hyperostosis of a "flowing" type, resembling molten wax running down the sides of a candle.

The authors' patient was a 61-year-old white male farmer, in whom roentgen studies revealed a flowing type of osteosclerosis extending from the right scapula, along the anterior and lateral aspects of the humerus, radius, navicular, greater and lesser multangular, first metacarpal, and all the phalanges of the right first digit. The acromion process, coracoid process, and neck of the right humerus showed areas of irregular, trabecular hyperostosis with normal density between them. In the upper end and head of the humerus there were areas of increased and decreased density, with trabeculae and bands of subperiosteal hyperostosis traversing the shaft of the bone in linear, wavy lines. These small bands tended to unite in the upper third of the humerus on the anterior and lateral aspects and flow down the shaft to the lateral supracondylar area. The elbow joint and periarticular structures were normal, but changes were present in the entire length of the right radius. A rather dense plate of bony hyperplasia was apparent in the distal end of the radius just under the articular cartilage.

Including the authors' report, 49 cases of melorheostosis are said to have appeared in the literature. The exact etiology of the disease is unknown. Gross pathological findings may include thickened bones, bones with irregular contour, bowed long bones, shortened extremities, atrophy of muscles in an involved limb, associated skin changes overlying the osteosclerosis, and impaired vascular efficiency. The microscopic picture is bizarre and not diagnostic. Symptoms, if present, are in general vague, insidious, and intermittent. Prognosis is good and the disease is benign.

An accurate diagnosis can be made only upon roentgen examination. Since the condition is so chronic, one should rule out tuberculosis and syphilitic osteitis by the history, serology and other laboratory tests. The history will also aid in excluding infectious and posttraumatic ossifying periostitis. Although calcification in periarticular structures does not occur in some cases of long-standing melorheostosis, the concomitant osteosclerosis in adjacent bones should differentiate it from myositis ossificans and calcinosis. Such atypical osteosclerosis as osteopoikilosis, Albers-Schönberg's disease, Paget's disease of the bone, chronic osteomyelitis, and Garré's non-suppurative sclerosing osteomyelitis should be considered in the differential diagnosis. No rational definitive treatment is known.

Four roentgenograms; 1 drawing; 3 charts.
DANIEL WILNER
Atlantic City, N. J.

Roentgenologic Findings in Osteomyelitis Following Bone Marrow Infusions in Infants. Review of the Literature and Report of Two Cases. E. Clinton Texter, W. A. Irwin, and D. H. Kaump. Am. J. Roentgenol. **62:** 534–540, October 1949.

Two cases of osteomyelitis in infants, following continuous intraosseous infusions, are reported. Both responded to treatment by penicillin. A series of 4 roentgenograms of the left femur in one case and of the right tibia in the other show the bone defects and their subsequent healing. Nineteen additional cases were found in the literature and are summarized in a table.

In the three largest series of interosseous infusions reported, the incidence of osteomyelitis was only 0.41 per cent, but when only cases of continuous infusion and those receiving hypertonic solutions are considered, the incidence rises to 6 to 13 per cent.

Intraosseous infusions are contraindicated in the presence of severe skin or generalized blood stream infections.

ALBERT R. BENNETT, M.D.
Mt. Sinai Hospital of Cleveland

Pathologic Picture of Mutilating Arthritis. Walter Naumann. Fortschr. a. d. Geb. d. Röntgenstrahlen **71:** 467–471, July 1949. (In German)

The author presents the clinical history and autopsy findings in the case of a 46-year-old woman with a chronic polyarthritis of about twenty years standing, in the course of which mutilating bone absorption developed in both hands and feet, combined with subluxations and telescoping of the overlying soft tissue. At the same time, chronic infectious changes were noted in the nose, paranasal sinuses, and lungs, resulting in bronchiectasis. Anaphylactic manifestations were apparent in the skin, the eyes, and the lymph nodes. Finally, the Mikulicz syndrome ensued. It is assumed that the original infection was located in the paranasal sinuses.

Three roentgenograms; 1 photograph.

ERNST A. SCHMIDT, M.D.
Denver, Colo.

Decalcification Zones in the Epiphyseal Regions in Arthrosis Deformans and Senile Osteoporosis. G. H. Schmitt. Fortschr. a. d. Geb. d. Röntgenstrahlen **71:** 483–486, July 1949. (In German)

In a 70-year-old woman, one year after x-ray irradiation of the knee joint for arthrosis deformans, zones of decalcification appeared in the regions of the previous epiphyseal lines of the tibia and femur. It could not be definitely decided clinically whether these changes were due to irradiation or to rachitic malacic osteopathy or to circulatory disturbances. Hunger osteopathies and D-hypervitaminoses may produce similar atypical pictures of decalcification.

Three roentgenograms.

ERNST A. SCHMIDT, M.D.
Denver, Colo.

Hypertrophic Osteoarthropathy; Report of a Case Associated with a Chordoma of the Base of the Skull and Lymphangitic Pulmonary Metastases. Nathaniel Uhr and Jacob Churg. Ann. Int. Med. **31:** 681–691, October 1949.

In the majority of cases, osteoarthropathy, with its concomitant clubbing of the fingers and toes, is seen as a sequel of chronic suppurative or neoplastic disease of the thoracic organs, less commonly of the abdominal viscera. In rare instances, the condition has been known to precede the manifestation of the underlying disease, as in the case recorded here. When this occurs, diagnosis is often impossible until late.

The authors' patient was a 21-year-old white male with a chordoma at the base of the skull, which was characterized by a high degree of malignancy, unusual for chordoma, by pulmonary metastases, and by early and massive hypertrophic osteoarthropathy. The pulmonary involvement produced no chest symptoms for a long time, during which it was confined to the lymphatics, yet accompanied by rapid and extensive hypertrophic osteoarthropathy. The changes in the long bones consisted of marked deposition of newly formed bony trabeculae under the periosteum and thickening of the periosteum itself. Atrophic changes were demonstrable about the knees and ankles. Roentgenograms of the skull revealed marked osteoporosis of the sella turcica with some erosion of the floor and the posterior clinoid processes.

Autopsy confirmed the clinical impression of extensive neoplastic involvement of the lungs and massive hypertrophic osteoarthropathy. The changes at the base of the skull were found to be caused by a malignant tumor identical in structure with that in the chest. The pulmonary involvement was of the "lymphangitic" variety, with only secondary infiltration of the parenchyma, bronchial walls, and blood vessels. No particular area could have been designated as the primary focus, a fact which argued against primary pulmonary neoplasm with metastases to the base of the skull.

The microscopic structure showed a polymorphous appearance with syncytial-like structure, vacuolization of the cytoplasm, accumulation of intercellular mucinous substance, and a tendency to arrangement around clear spaces, which strongly suggested the diagnosis of chordoma. The topography of the tumor, the location of the most differentiated areas beneath the sella turcica, and the expansion of the involved bones testified to the intraosseous origin of the growth.

Four roentgenograms; 11 photographs and photomicrographs.

STEPHEN N. TAGER, M.D.
Urbana, Ill.

Marfan's Syndrome. Report of a Case. Raymond A. Adams and William B. Porter. South. M. J. **42:** 844–848, October 1949.

A case of Marfan's syndrome in a Negro is reported. The typical symmetric elongation of the bones of the extremities was present but no ocular or cardiac defects were demonstrable. There was an associated spontaneous pneumothorax attributed to rupture of a congenital bleb on the surface of the lung.

Four photographs.

Sickle Cell Disease Simulating Osteomyelitis. Joseph Buchman. Bull. Hosp. Joint Dis. **10:** 239–251, October 1949.

The general skeletal changes in sickle-cell anemia have been described a number of times (coarse trabeculation, biconcave vertebrae, skull striations, etc.) and in no way resemble osteomyelitis. In the case reported here, however, a local process in the left fibula was strongly suggestive of the latter condition. It appears in retrospect that thrombosis (a frequent phenomenon in sickle-cell anemia) of the nutrient artery of the bone occurred, with resulting aseptic necrosis of most of the shaft.

A series of films show characteristic progression of periosteal thickening, involucrum formation, and gradual molding to an almost normal appearance in two years time. The x-ray findings were entirely typical of osteomyelitis but clinical findings were limited to some local pain, with no swelling, tenderness, or constitutional reaction. The author believes that this condition is probably present in other cases of sickle-cell anemia but goes unrecognized because of the mildness of the symptoms.

Eight roentgenograms. ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Roentgenographic Differentiation Between Torsion and Rotation in Fractures of the Forearm. Henry Milch. Bull. Hosp. Joint Dis. **10:** 216–225, October 1949.

Torsional malalignment of fracture fragments may be recognized in most recent cases by demonstrating "cross-sectional incongruence," that is, failure of accurate apposition of the large diameter of one fragment to the large diameter of the other. This is manifested by a discrepancy in width of the ends of the fragments regardless of the position in which they are examined.

After callus formation has taken place, the incongruence is smoothed out and the presence of torsion can be detected only by including the entire bone in each projection. If torsion is present, inconsistencies will be manifest, *e.g.*, the upper end may show a normal anteroposterior view while the lower end appears lateral or oblique.

In the forearm one must be careful to differentiate torsion from the rotation which takes place in pronation and supination, by making certain that proper positioning is used. Where the arm is encased in plaster, the author suggests incorporating a length of wire in the outer layers of the cast as a standard of comparison. Absence of rotation will be characterized by identical projection of the shadow of the steel wire on the roentgenogram. Paralactic change in the position of the wire shadow proves the existence of rotation of the part with respect to the x-ray beam or the underlying roentgen film.

Nine roentgenograms; 1 drawing.
ZAC F. ENDRESS, M.D.
Pontiac, Mich.

An Analysis of the Management and Complications of Multiple (Three or More) Rib Fractures. Duncan A. Cameron, Paul V. O'Rourke, and Charles W. Burt. Am. J. Surg. **78:** 668–676, November 1949.

In 65 per cent of 109 cases of multiple rib fracture treated at the City of Detroit Receiving Hospital complications were found to have developed, including, in order of frequency, "wet lung" (increased bronchial secretion on a reflex basis aggravated by indisposition of the patient to cough and followed by patchy atelectasis), interstitial emphysema, accumulation of blood and fluid in the pleural space, reflex ileus, pneumothorax, and paradoxical respiration. There were 4 deaths, due to associated injury to other parts or to intrathoracic hemorrhage.

The high incidence of complications was partly explained by the fact that in most instances the chest trauma was severe, and was often accompanied by fractures of bones other than ribs; but it is pointed out that rib fractures, often passed over lightly in the presence of more obvious injuries elsewhere, are capable of causing serious consequences and should be actively treated.

Strapping and the use of narcotics are condemned, the authors preferring intercostal block in simple cases and water seal pleural drainage in cases associated with pneumothorax and/or pleural fluid. When paradoxical movements of the chest are present, treatment should be by traction applied to the sternum with a tenaculum.

The difficulty of roentgen diagnosis from single films is stressed and multiple serial films are recommended.

Eleven illustrations, including 9 roentgenograms; 5 tables. W. C. OWSLEY, JR., M.D.
University of Pennsylvania

Short Radius. Henry Milch. Arch. Surg. **59:** 856–869, October 1949.

A group of 8 cases in which the salient anatomic feature was a shortened radius form the subject of this report. The defect is manifested clinically by "so-called dislocation of the ulna"—a misnomer—with malfunction of the wrist. It differs from Madelung's deformity in that the characteristic curvature of the radius is absent. The disparity of the bones is best corrected by shortening the shaft of the ulna, which restores function without jeopardizing the stability of the wrist, which is sometimes lost after resection of the lower end of the ulna.

Seventeen roentgenograms.
LEWIS G. JACOBS, M.D.
Oakland, Calif.

Vertebral Tomography in Actual Practice. Herdner. J. belge de radiol. **32:** 128–156, 1949. (In French)

This rather lengthy article deals in great detail with tomographic examination of the vertebral column. At first the shortcomings of conventional radiography of the spine are discussed, with the major emphasis on the upper cervical area. The author then presents an extremely meticulous technic for investigation of each vertebra independently. Points of orientation on the skin are designated, along with very careful positioning of the patient. The desirable thickness of each plane of section is stated, as well as the type of film and intensifying screen to be used for each isolated segment. An upright machine with a long target-film distance is employed, with the patient sitting or standing. Oblique projections and, in a few instances, views with angulation of the tube are presented.

Nineteen roentgenograms of excellent quality and ten drawings are reproduced to illustrate anatomic and technical points and also to demonstrate lesions which were seen poorly or not at all in conventional roentgenograms. Most of these lesions were in the nature of early osteomyelitis or early tuberculous caries. The author states that tomograms carefully obtained are invaluable in studying early bony lesions of the spine and should be taken whenever the least degree of suspicion enters the mind of the radiologist. E. M. SAVIGNAC, M.D.
Detroit, Mich.

Subluxation of the Atlanto-Axial Joint: Sequel to Inflammatory Processes of the Neck. Albert W. Sullivan. J. Pediat. **35:** 451–464, October 1949.

Subluxation of the atlanto-axial joint occurs almost exclusively in children. It is usually preceded by an infection of the tissues of the neck, as tonsillitis, cervical

adenitis or abscess, coryza, otitis media, etc. Four cases are described.

Subluxation is of three types: anterior unilateral, posterior unilateral, and anterior bilateral. In each there are pain and limited motion of the neck, with tilting of the head. The joint capsule or capsules between the lateral masses of the atlas and the axis become distended by effusion, permitting a slipping or minor dislocation (subluxation) on spasm of the paravertebral muscles, minor trauma, or passive manipulation.

Roentgen findings on conventional films are minimal. In 3 of the 4 cases recorded here the roentgenograms were considered normal by the radiologist. The anteroposterior open-mouth view may show overlapping of the facets with reduction of the joint space on the affected side. The odontoid process may show lateral displacement. In the lateral view, there may be anterior displacement of the body of the atlas. Stereoscopic views as well as laminagrams may be helpful. Since the roentgen findings are so often negative or questionable, the clinical findings are more useful in suggesting and establishing the diagnosis.

Treatment consists of immobilization with the neck in hyperextension, and the prognosis is good.

Four illustrations, including 1 roentgenogram; 1 table.

CORNELIUS COLANGELO, M.D.
Chicago, Ill.

Non-Pathologic Variations in Relationship of the Upper Cervical Vertebrae. Lester W. Paul and William W. Moir. Am. J. Roentgenol. **62:** 519–524, October 1949.

Occasionally the atlas appears to be displaced laterally in relation to the dens so that the spaces on either side are asymmetrical. The frequency of such an appearance, and the effect of distortion by improper positioning and of lateral bending and forceful flexion were investigated.

Anteroposterior and lateral roentgenograms were made of 25 normal students, with the head in neutral position; 9 showed some asymmetry. Another group of 9 subjects were examined (1) in neutral position, (2) with head flexed to either side, and (3) with chin rotated to either side. Where an asymmetry was present, it was exaggerated by tilt to the narrower side and corrected by tilt to the opposite side. In some cases a distinct lateral motion of the atlas on the axis could be demonstrated.

In the absence of other roentgenographic evidence, no diagnostic significance can be attached to an asymmetry of the spaces between the dens and the lateral masses of the atlas.

Nine roentgenograms.

ALBERT R. BENNETT, M.D.
Mt. Sinai Hospital of Cleveland

Herniated Disks and Vertebral Ligaments on Native Roentgenograms. Ákos Kovács. Acta radiol. **32:** 287–303, Oct. 31, 1949.

The author points out some of the shortcomings of myelography and suggests that a more rigorous lumbosacral area roentgenography be employed. With his technic, utilizing simple plain films, he claims to find myelography superfluous in 80 per cent of cases.

Herniated Disks: Signs visible on plain films presumptive of disk degeneration are: (1) a narrowed disk, the missing part of which cannot be visualized as bulging laterally or forward; (2) a unilateral or bilateral spondylolysis associated with the disk deformity.

The even contraction of the intervertebral disk due to the aging process becomes manifest on oblique films of the lumbosacral areas as a moderate subluxation of the apophyseal joints. However, an exaggeration of this subluxation at a single area or level points a presumptive finger at the seat of isolated disease of intervertebral disk origin. Occasionally it may represent the site of herniation. According to the author, a herniated disk may be very nearly definitely diagnosed if the smooth curvature of the vertebral margins posteriorly is disrupted, particularly when the spinal column is bent at various angles.

Often, with correct technic, it is possible to demonstrate the cartilaginous hernia roentgenographically, even without the presence of calcific granules. In the author's experience, the cartilage not infrequently contains granules of lime salts and as a consequence the contrast in the interspinous region is more pronounced and more easily visible.

The author strongly stresses the formation of osteophytes at the posterior edge of the vertebrae as a sure sign of there having been or actually being a herniated nucleus pulposus and/or disk degeneration. As a rule, osteophytes are produced at those places where movements are greatest and ligaments are most distended. The nucleus pulposus bulges backward, or the annulus fibrosus glides backward, giving rise to a distention of the periosteum which is adherent to the longitudinal ligament. Consequently spurs are formed and they invariably follow the protrusion of the disk. A small osteophyte protruding backward is a sure sign that a much larger part of the disk has projected backward. Posterior osteophytes occur with special frequency on the lower margin of the 5th lumbar vertebra. In 1948 Solomon reported on 629 cases in which he was able, by means of the usual films, to demonstrate marginal osteophytes giving rise to a radiculitis in 2 per cent of his cases. The author, with his specialized technic, found osteophytes and calcified cartilaginous hernias in 117 of 175 cases. Forty of these patients were operated on, and 36 cases were proved at operation. The author calls these posteriorly projecting marginal osteophytes "sciatic hooks." Apparently oblique films would be very beneficial in demonstrating these sciatic hooks, which would be shown to project, in some cases, into the intervertebral foramina.

There is no correlation between the size of the sciatic hooks and that of the cartilage hernia. Initially, while the hook is being developed, it is smaller than the hernia. After some months, and repeated recurrences, the hook reaches about as high as the upper margin of the hernia. Several years later the hook may still be present, whereas the cartilage, owing to fluid loss, undergoes shrinkage. At this time the osteophyte or hook may be the sole cause for symptoms.

Meninges and Spinal Ligaments: Calcification of these structures is, of course, preceded by swelling and thickening of the ligament. Any visible calcification must have been preceded by a considerably more extensive inflammatory process. In an occasional case a torn longitudinal ligament can be demonstrated by virtue of being calcified.

Transitional Vertebrae: The evaluation of the relationship of a transitional vertebra at the lowest lumbar level with the presence of symptoms, the author sug-

gests, is quite difficult. If there is a transitional vertebra between the iliac bones, the overlying vertebrae cannot be fixed by elastic ligaments, and the junction of the fixed sacral bone and the mobile lumbar spine results in an overloading of the cartilages in the region, giving rise to degenerations.

Twenty-six roentgenograms; 1 diagram; 2 tables.

E. S. KEREKES, M.D.
University of Arkansas

Herniated Intervertebral Discs Producing Contralateral Symptoms and Signs. Report of Two Cases. Abraham Kaplan. Bull. Hosp. Joint Dis. **10:** 207–215, October 1949.

Two cases are reported in which large protruded lumbar disks caused symptoms and signs on the side opposite the protrusion. Myelography led to the correct diagnosis in one case but in the other there was almost a complete block which apparently prevented lateralization.

No explanation for this occurrence is offered, but it is pointed out that without the myelographic evidence operation might have been confined merely to exploring the negative side and the lesions would have been missed.

Five roentgenograms; 3 photographs.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Varicosities of the Spinal Canal Veins in the Lumbar Region Simulating Disc Herniations. Arnold D. Piatt. Ohio State M. J. **45:** 979–982, October 1949.

Varicosities of the spinal canal veins, intradural or pial, may produce the clinical picture of disk herniation. Myelography will reveal one or several filling defects. If the defect is not at the level of a disk there should be no problem provided one realizes that a varicosity can produce such a picture. When the defect is seen at the level of a disk, the problem of differentiation is more difficult. The varicosity tends to change at least slightly in size or shape while the disk remains constant. Multiple defects are probably more common with varicosities. One other helpful sign is the presence of "trapped" droplets of oil, thought to be in the furrows between the tortuous vessels.

Two cases are reported and illustrated, one diagnosed correctly before surgery.

Diffuse arachnoiditis and tumors are also mentioned as closely simulated by extensive varicosities.

Three roentgenograms. ZAC F. ENDRESS, M.D.
Pontiac, Mich.

A Contribution to the Differential Diagnosis of Inflammatory Diseases of the Spine. Karl H. Erb and C. Montag. Fortschr. a. d. Geb. d. Röntgenstrahlen **71:** 462–466, July 1949. (In German)

In a 36-year-old man, all vertebral bodies from D-9 to L-4 showed extensive marginal bone defects combined with narrowing of the intervertebral spaces and bony sclerosis. Osteopetrosis, osteopoikilosis, melorheostosis, osteitis deformans, osteochondritis, tuberculosis, and tumor involvement are considered and excluded in the differential diagnosis. In the authors' opinion, subacute osteomyelitis or infectious spondylitis in consequence of an operative blockage of the lumbar sympathetic nerve appears to be the diagnosis of choice.

Three roentgenograms; 2 drawings.

ERNST A. SCHMIDT, M.D.
Denver, Colo.

Aseptic Necrosis of the Femoral Head Simulating Tuberculosis. Carl E. Rothschild. Bull. Hosp. Joint Dis. **10:** 226–232, October 1949.

An unusual case of aseptic necrosis of the femoral head is presented, which followed a fall, without evidence of fracture or dislocation. The patient was fifty-five years of age and in good health. A roentgenogram was first taken a year after the accident, although symptoms had started a few weeks afterward, becoming progressively worse. This showed destruction of the femoral head and acetabulum. Six months later, when the patient entered the hospital, the destructive process was more advanced; eburnation was present, and the acetabulum was of the so-called "wandering" type. Most of the joint surface was destroyed and clinically only 5 degrees of motion remained. Tuberculin tests were negative but tuberculosis was considered the most likely diagnosis.

Fusion of the hip was done and the gross and microscopic appearance was characteristic of aseptic necrosis, with no sign of tuberculosis.

[It is most unfortunate that roentgenograms were not made earlier in this interesting case.]

Three roentgenograms; 1 photomicrograph.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Opaque Arthrography of the Knee Joint. A. E. Jowett. Ann. Rheumat. Dis. **8:** 149–155, June 1949.

Since March 1946, the author has examined 47 knees in 44 patients by opaque arthrography. The appearance of the normal and some abnormal arthrograms is described and illustrated. No special radiographic technic has been used. Anteroposterior lateral and anteroposterior oblique views (with the limb medially and laterally rotated to 45 degrees) are taken routinely. A tangential view of the patello-femoral joint is taken, where indicated, as are also postero-anterior oblique views. The contrast media used were pylumbrin and diodrast.

Sixteen roentgenograms.

Variations in the Bony Structure of the Human Foot. H. Schlichter. Fortschr. a. d. Geb. d. Röntgenstrahlen **71:** 498, July 1949. (In German)

A supernumerary ossicle lateral to the proximal head of the first metatarsal was demonstrated roentgenographically. A similar, though smaller, ossicle was noted at the symmetrical site of the opposite foot. These ossicles probably represent rudimentary supernumerary metatarsals.

One roentgenogram; 1 drawing.

ERNST A. SCHMIDT, M.D.
Denver, Colo.

Synovial Osteochondromatosis. Stanley M. Leydig and Richard T. Odell. Surg., Gynec. & Obst. **89:** 457–463, October 1949.

Synovial osteochondromatosis is an uncommon affection of the synovial membranes of the knee, elbow, ankle, hip, and shoulder. It occurs most frequently in males between the ages of thirty and fifty. The authors consider it to be a benign neoplasm with trauma and

infection as frequent excitant factors in its etiology. They present four cases to substantiate this theory.

The symptoms are pain and limitation of motion in the involved joint. The roentgen picture is characteristic, revealing multiple loose osteocartilaginous bodies in the joint space unless the loose bodies are entirely cartilaginous, in which event the findings are negative. The condition should not be confused with osteophytes which have broken off or with joint mice.

Pathologically, the synovium is thickened, and cartilaginous loose bodies form which may become detached from the synovium. The bodies consist of a superficial fibrous layer overlying hyaline cartilage. The center is frequently calcified or ossified. Degenerative changes resembling hypertrophic arthritis may occur secondarily. Treatment is surgical.

Eighteen roentgenograms; 5 photographs.

ROBERT J. AYELLA, M.D.
University of Pennsylvania

Operative Technic for Calcified Tendons About the Shoulder Joint. Russel H. Patterson and Robert Lee Patterson. Am. J. Surg. **78:** 582–586, November 1949.

The authors discuss the anatomy, pathogenesis, and surgical treatment of calcified tendinitis and secondary subacromial bursitis. An accurate diagnosis is essential and can be made by a careful history, physical examination, and proper x-ray study.

The tendons of the supraspinatus, infraspinatus, and teres minor muscles blend with the capsule of the shoulder joint. The supraspinatus tendon forms the roof of the capsule and the floor of the subacromial bursa. The calcified deposits within the tendon may become heaped up and encroach upon the floor of the bursa, interfering with motion, acting as a foreign body under the bursa and causing it to become inflamed.

Because the shoulder is painful, the roentgenologic views are frequently not ideal. Adequate films may be obtained by the technic previously described by Lewis (Surg., Gynec. & Obst. **67:** 38, 1938). The arm and shoulder are left in the sling, and with the patient standing or sitting, the body, rather than the shoulder, is rotated to give the desired projections. In chronic cases there is a hard, fixed deposit in one or more tendons; in subacute cases there may be a soft, irregular, mottled deposit, as well as one or more hard deposits; acute cases show a cloudy diffuse shadow in or under the bursa, rarely in the shoulder joint.

The authors believe surgery is indicated in all patients with unruptured single or multiple hard deposits and in all cases with mixed hard and soft deposits. The three objectives are: (1) relief of tension in the distended tendon or bursa; (2) removal of the calcium, which acts as a foreign body; (3) revascularizations of the defective area in the tendon.

Five roentgenograms; 3 drawings.

JOHN F. WEIGEN, M.D.
University of Pennsylvania

GYNECOLOGY AND OBSTETRICS

The Radiological Localisation of the Placental Site. Part I. Normal Implantation. Part II. The Radiological Diagnosis of Placenta Praevia. F. Reid. Brit. J. Radiol. **22:** 557–566, 643–665, October and November 1949.

In Part I of his paper the author reviews briefly the history of placentography and outlines the various methods used. Soft-tissue radiography, according to a technic previously published (Reid: Brit. J. Radiol. **22:** 81, 1949), was employed in a series of 252 cases submitted to x-ray examination for a wide variety of reasons. The incidence of anterior and posterior implantation based on the radiographic appearances was approximately equal. The site of implantation was determined clinically in 42 of these cases (in 41 at cesarean section and in 1 during manual removal of the placenta). The x-ray diagnosis was confirmed in 41 of this number.

In Part II, the methods used in the diagnosis of placenta previa are first analyzed. Amniography is not recommended because of the entailed risk, although its accuracy is high. Cystography is applicable only in cephalic presentations according to most authors. This method is reviewed in detail, as originally introduced by Ude and his associates (see for example Abstracts in Radiology **24:** 514, 1935; **32:** 749, 1939) and as subsequently modified by others.

The radiological diagnosis of placenta previa without the use of a contrast medium rests upon the following assumptions: (1) In vertex presentations before engagement the fetal head normally rests symmetrically on the pelvic brim when the mother is standing upright. (2) The junction of the upper and lower segments is usually in the neighborhood of the pelvic inlet during the last two or three months of pregnancy. (3) If implantation extends on to the lower segment, the fetal head will be displaced by the placenta from its normal position at the brim.

Evidence of placenta previa may be found in anteroposterior and lateral views made with the patient standing or partially erect. The highest degree of accuracy is obtained when the head is presenting, though with a breech presentation a very high-lying fetus, with no placenta visualized elsewhere, probably indicates a placenta previa. With a vertex presentation, in the presence of placenta previa the head will be displaced forward or backward or laterally and somewhat upward.

In general, if the distance between the presenting part and the symphysis or the promontory of the sacrum is less than 1.5 cm. there is no placenta previa. A distance of 1.5 to 2.0 cm. is not necessarily abnormal but may be due to a partial placenta previa. With 2.0 cm. or more a low-lying normal implantation cannot always be excluded, but placenta previa is more likely the more the presenting part is displaced, either anteroposteriorly or laterally and the nearer the pregnancy is to term.

The method described is considered more accurate than cystography, and is applicable to all types of cases, regardless of the patient's condition. By this means 47 out of 50 cases of clinically confirmed placenta previa were identified. In the differential diagnosis, a full bladder, excessive fecal matter in the rectum, pelvic tumors, accidental hemorrhage, lax abdominal muscles, an abnormally small presenting part, and excessively steep inclination of the brim must be considered.

Part I includes 7 roentgenograms, 5 drawings, and 2 tables; Part II, 18 roentgenograms, 14 drawings, and 3 tables.

SYDNEY J. HAWLEY, M.D.
Seattle, Wash.

Angiocardiographic Studies of the Human Foetal Circulation. A Preliminary Report. John Lind and Carl Wegelius. Pediatrics **4:** 391–400, October 1949.

Angiocardiography was carried out on human fetuses eighteen to twenty-two weeks of age, obtained

in cases of legal abortion. The technic and apparatus for obtaining roentgenograms on full-sized cassettes at a rate of 10 per second are described. The radiographic procedure was performed in the operating room within one-half to one minute after the incision of the intact membranes, the fetus having been delivered by cesarean section. An electric radiator was immediately placed above the fetus and 70 per cent umbradil was injected *via* the umbilical vessels. In a number of cases the findings were verified at autopsy, a solidifying contrast medium having been injected and roentgenograms made in the same position as for angiocardiography. The films were then correlated with the angiocardiograms and anatomic findings.

The system was found suitable for adequate visualization and delineation of the hepatic circulatory system, ductus venosus, the cardiac chambers and the great vessels. Cardiac action continued until after the heart and great vessels had been adequately opacified, allowing assessment of the circulatory dynamics and course of the blood stream. The fetal pulmonary circulation showed only slight filling, an expression of its assumed partial segregation from the general circulation during fetal life.

Thirty-four roentgenograms; 2 photographs.

HARRY J. PERLBERG, JR., M.D.
New York, N. Y.

Gas-Containing Ovarian Abscesses. Karlhans Siemon. Fortschr. a. d. Geb. d. Röntgenstrahlen **71:** 454–458, July 1949. (In German)

Two cases of ovarian abscesses are described in which the x-ray examination provided a positive preoperative diagnosis due to extensive gas accumulation in the abscesses. A barium enema is necessary in such cases to exclude intestinal involvement and to facilitate a more specific diagnosis regarding adhesions, relating to neighboring organs, etc.

Five roentgenograms. ERNST A. SCHMIDT, M.D.
Denver, Colo.

THE GENITO-URINARY SYSTEM

The Roentgen Diagnosis of Lesions of the Urinary Tract. H. Dabney Kerr. Minnesota Med. **32:** 1077–1085, November 1949.

The author believes that the intravenous urogram has been of distinct advantage in the diagnosis of lesions of the urinary tract, but that it is of more value in ruling out disease than in establishing a diagnosis from apparently abnormal findings. Retrograde pyelography in correlation with the clinical observations is the most reliable approach.

Ability to discern abnormal from normal is obviously of paramount importance in studying a system where anatomical variations are so frequently encountered. Various anomalies are briefly discussed.

Polycystic kidney disease is bilateral, familial, and congenital. Grossly enlarged renal shadows, distorted, compressed, elongated calyces, and relative decrease in the size of the renal pelvis are the usual roentgen findings. Bilateral pyelograms should always be obtained, since the deformity, if seen unilaterally, closely resembles a renal neoplasm.

Renal calculi are ordinarily visualized because of their calcium content. The importance of a preliminary plain film of high quality is stressed as a prerequisite in every case of suspected calculus. Diffuse parenchymal calcifications may occur in hyperparathyroidism or following excessive calcium or Vitamin D intake. Any factor which causes necrosis of renal tissue may lead to amorphous renal calcific deposits.

Hydronephrosis may be difficult to diagnose in early stages and at this time intravenous urograms may be of more value than the retrograde studies. Dilatation incident to pregnancy is a normal finding. Although it is frequently referred to as "pyelitis of pregnancy," infection is often absent.

In suspected cases of renal neoplasm, retrograde pyelography should always be done. The changes vary from a single deformed calyx to the "spider leg" deformity resembling a polycystic kidney. Calcification occurs in approximately a third of the cases. Neoplasms of the renal pelvis are much less common but should be considered when stone can be ruled out. In Wilms' tumor, the plain films reveal a large mass, and pyelograms show renal displacement and pelvic distortion. Blood clots may be impossible to distinguish from tumors of the renal pelvis or from non-opaque stones.

The roentgenologic findings in non-tuberculous acute infections, renal "carbuncle," chronic pyelonephritis, perirenal abscess and the various stages of renal tuberculosis are also described.

Fewer pathological conditions occur in the ureter than in the kidney. Because of obstruction and subsequent renal damage, it is important to discover even the smallest of ureteral calculi. The "beaded" appearance of the ureter may be the only indication of renal tuberculosis. Primary neoplasms of the ureter are uncommon; implants from renal pelvic neoplasms are more frequently seen.

In lesions of the bladder, cystoscopy is perhaps the best procedure, but additional information can be obtained by a roentgen examination including plain films, opaque and air cystograms.

The roentgen appearance in diseases of the urethra and prostate is also discussed and illustrated.

Thirty-two roentgenograms.

WYLIE H. MULLEN, JR., M.D.
Cleveland Clinic Foundation

Eventration of the Diaphragm. Report of a Case Involving the Kidney. William Baurys and Spencer Servoss. Urol. & Cutan. Rev. **53:** 535–536, September 1949.

Eventration of the left leaf of the diaphragm with upward displacement of the splenic flexure of the colon and the left kidney is described. In this patient, the upper pole of the left kidney was at the level of the eighth rib and the lower pole at the eleventh rib. There was marked elongation of the ureter but no other abnormality. No surgery was advised since the symptoms did not warrant it.

Three roentgenograms.

BERNARD S. KALAYJIAN, M.D.
Detroit, Mich.

Renal Carbuncle (Staphylococcal Abscess of Kidney). Norbert M. Welch and George C. Prather. J. Urol. **62:** 646–650, November 1949.

The authors present a case report of a staphylococcal abscess of the kidney treated with penicillin with complete disappearance of the radiological evidence of the

disease. They found radiological studies a definite factor in making their diagnosis, though there are some who regard pyelography as, at most, of negative value. The authors go on to point out that the kidney function tests may give little information as to the extent of damage, as in their case, in which indigo carmine was used.

Four pyelograms. S. F. THOMAS, M.D.
Palo Alto, Calif.

THE SOFT TISSUES

Roentgen Diagnosis of Gas Formation in Tissues. R. Haubrich. Fortschr. a. d. Geb. d. Röntgenstrahlen **71:** 475–482, July 1949. (In German)

The different roentgenographic aspects produced by gas bacillus infection in the soft tissues are discussed in detail. The "feathery" appearance in muscle involvement is particularly stressed.

No references are given regarding the actual therapy employed or regarding the evaluation of radiotherapy *versus* other methods of treatment, a question which has created considerable interest in this country during the last decade. As it appears, radiotherapy was not applied in any of the reported cases, all of which involved war injuries.

Ten roentgenograms. ERNST A. SCHMIDT, M.D.
Denver, Colo.

TECHNIC; CONTRAST MEDIA

Direct Angiocardiography: Experiences with 10 Exposures per Second. J. Lind, C. Wegelius, G. Fredzell, and E. Wasser. J. Faculty of Radiologists **1:** 87–97, October 1949.

Angiocardiography has been carried out according to two main principles, either by direct radiography with normal full-sized films or by indirect photography of the fluorescent screen, and in the latter case eventually with x-ray cinematography. Direct radiography affords superior picture quality but has suffered in the past from lack of speed. Far greater speed—up to 10 exposures per second—has been achieved by the indirect method, but the pictures are small and unsatisfactory for detailed study. The authors describe in this communication their experiences with an apparatus which will give a speed of up to 10 exposures per second by direct radiography. Reduced irradiation of the patient, since he is exposed only while each film is made, and larger and clearer views are considered as definite advantages over indirect x-ray cinematography.

The apparatus utilizes an exposure time of 0.02 seconds, and a total of sixty cassettes can be exposed during a period of six seconds, which in children is the average time for the passage of the contrast medium through both the right and left sides of the heart and out through the aorta. Cassette size as yet has been limited to 13 × 18 cm., but will soon be enlarged in a new type apparatus. Seventy to 85 kv. and 300 to 450 ma. have been used in infants and children up to four years. Larger film size will be necessary for older patients, as well as improved technical facilities.

Illustrations of the films obtained with this method, as well as a diagram and a description of the apparatus, are included.

D. R. BRYANT, M.D.
The Henry Ford Hospital

Theoretical Foundations of a Method of Tomography Not Yet Practically Applied. Heinz Vieten. Fortschr. a. d. Geb. d. Röntgenstrahlen **71:** 487–496, July 1949. (In German)

The author discusses the tomographic methods of Olsson (Acta radiol. **23:** 420, 1942) and Perussia (Radiol. med. **30:** 115, 1943) and his own work along the same lines. The tomographic principles involved and the mathematical, geometric, and technical factors are treated in detail. The numerous tables, mathematical formulae, and calculations do not permit of satisfactory abstracting of this article, which should be read in the original by all interested in the basic aspects of tomography.

Ten diagrams. ERNST A. SCHMIDT, M.D.
Denver, Colo.

An Axial-Rotating Table. William A. Nosik. J. Neurosurg. **6:** 542–544, November 1949.

An axial-rotating table which has been designed to facilitate certain neurosurgical and neuroroentgenological procedures is described. The advantage of this table is that the patient can be rotated along his vertical axis without disturbing the sterile draping about the surgical field. During ventriculography, the patient can be rotated through an entire 360 degrees and the ventricles more effectively drained without any additional manipulation of the head. Upon completion of the drainage and the air injection, the roentgenograms can be taken with rotation through any desired arc to obtain any desired angle view of the ventricular system. This unit is also applicable to trephination, as for subdural hematoma, and in certain situations where it is desirable to maintain a constant head traction while a cervical laminectomy is being performed.

Four photographs. HOWARD L. STEINBACH, M.D.
University of California

Radiometry of an Inclined Plane. Paul Cave. J. Faculty of Radiologists **1:** 140–141, October 1949.

This author has previously described a method of accurately measuring horizontal diameters by two films, using a vertical tube shift. This communication describes a method of measuring an inclined plane such as would be found in a Naegele or scoliotic rachitic pelvis. The method uses 2 films with a vertical shift in the tube. Experiments with a dry pelvis have proved the method accurate in all inclinations up to 60 degrees.

Three diagrams. D. R. BRYANT, M.D.
The Henry Ford Hospital

Compounds of Zirconium for X-ray Media. Samuel W. Hunter, James Miree, and Henry Bloch. Surgery **26:** 682–684, October 1949.

In an attempt to find a substance which would render brain tumors radiopaque, the authors investigated zirconium. This was found to be relatively non-toxic when injected intraperitoneally in mice and to approach lead in radiopacity. It was hoped that by placing the zirconium in an anion state the blood-brain barrier would not be penetrated but that areas of altered physiology would permit the compound to collect and become radiopaque. With this in view, sodium zirconyl citrate was prepared, but at the time of writing the authors had been unable to demonstrate a brain tumor by its use.

In experiments on dogs, satisfactory roentgenograms

of the intestinal tract were obtained with sodium zirconyl citrate and zirconyl oxide. Practically 100 per cent of the compound was found to be excreted from the bowel in five to six hours, and it is suggested that a solution of zirconium might be a useful medium for study of the intestinal tract when obstruction is suspected.

Intravenous injection of sodium zirconyl citrate gave excellent visualization of the renal parenchyma in rabbits, but the experimental substance proved too toxic in its impure form for practical application.

Two roentgenograms. ALFRED O. MILLER, M.D.
Louisville, Ky.

Further Studies with Viscous Umbradil (Umbradil-Viskös): Its Indications and Technical Application. Olallo Morales. Acta radiol. **32:** 317–336, Oct. 31, 1949.

The author reports further studies (see Morales and Heinwinkel: Acta radiol. **30:** 257, 1948. Abst. in Radiology **53:** 303, 1949) with the viscous, water-soluble, innocuous contrast medium Umbradil-Viskös. Three types of this medium are described here: Umbradil-Viskös B, Umbradil-Viskös H, and Umbradil-Viskös U, for bronchography, hysterosalpingo-pelvigraphy, and urethrography, respectively, and the indications and technic, especially for bronchography and hysterosalpingo-pelvigraphy are presented.

Viscous Umbradil consists mainly of Umbradil (diethanolamine salt of 3,5-diiodo-4-pyridone-N-acetic acid), mixed with a viscosity-increasing substance, carboxymethylcellulose.

In spite of its rather high viscosity, the surface tension of Umbradil Viskös is relatively low, so that it can reach even small pockets and very narrow channels such as the finer branches of the prostatic gland ducts. By spreading rapidly because of its low surface tension, it can, furthermore, cover large surfaces such as the mucosa of the trachea. Thus it is entirely superfluous to add a medium that reduces surface tension. As can be seen on roentgen films, Umbradil proper is excreted by the kidneys.

According to the author, this highly viscous and water-soluble medium is especially well suited for examinations of the bronchial tree, the male and female sex organs, ducts of different glands, and fistulous tracts. Because of its high osmotic pressure and the well known specific sensitivity of the meninges against diiodo-pyridone-N-acetic acid, the preparation is not suitable for myelographic studies. There is also no advantage in using this contrast medium for arthrography.

Nineteen excellent roentgenographic reproductions.
E. S. KEREKES, M.D.
University of Arkansas

An Experimental Study of an Iodine Emulsion for Hepato-Lienography. Maria E. Grossmann and G. H. Cooray. J. Faculty of Radiologists **1:** 112–120, October 1949.

The experimental use of an iodine emulsion for x-ray visualization of the liver and spleen in experimental animals is described in this paper. Rabbits, guinea-pigs, and mice were used as experimental animals and suffered no untoward effects from parenteral administration of the emulsion. The time for appearance of the shadow was found to vary with the animals. In mice the maximum density of the liver shadow was reached at the end of one hour, in rabbits in one to two hours, and in guinea-pigs in about one hour and twenty minutes. The spleen does not become opaque in all animals; when seen, it is usually visualized just after the liver shadow reaches its maximum density.

The authors confirmed the findings of Ehrhardt (Zentralbl. f. Gynäk. **63:** 2335, 1939) that the same contrast medium shows up the placenta in pregnant guinea-pigs.

Sixteen roentgenograms. D. R. BRYANT, M.D.
The Henry Ford Hospital

RADIOTHERAPY

Radiotherapy. J. Belot. J. belge de radiol. **32:** 121–127, 1949. (In French)

This rather informal talk by one of the deans of French radiology reviews broadly the trends in roentgen therapy from its earliest days to our times. The author still uses the classification adopted years ago of superficial therapy utilizing up to 80 kv.p., intermediate therapy extending from 80 to 120 kv.p., and deep therapy reaching to and extending beyond 200 kv.p. Technical advances through the years have permitted the use of a widely varying range of voltages, but the original classification still holds true. Superficial therapy has been expanded to the use of contact therapy at very low potentials; intermediate therapy, relying on a choice of filters to alter the quality of the rays, has changed but little; deep therapy, on the other hand, has now reached 100 million volts and may well go beyond.

A broad perspective shows that radiotherapy has used wave lengths of marked differences and has utilized these frequently in a highly empirical manner, based on concepts which only too often have not been proved.

Beginning necessarily with low potentials because no others were available, radiotherapy progressed rapidly to the 200-kv. stage, which gave highly encouraging results in deep-seated tumors with little damage to the skin. The old principle was then formulated of the radiosensitivity of immature or anaplastic cells while the healthy tissue remained relatively radioresistant. This wave length afforded protection to the skin and led to great enthusiasm. It was then thought that any method which could increase the depth dose would lead to a great improvement in results. Thus the potential increased rapidly and no thought was given to the quality of the radiation used; the quantity was the prevailing factor. The higher voltages, however, have not lived up to expectations and present practical difficulties entirely out of proportion to the results obtained. Furthermore, the enhanced dosage due to diffusion and to the Compton effect has increased radiation in the deep-seated tissues to ten, twenty, and even thirty times the surface dose, while the limitation of the rays to diseased tissue and the avoidance of damage to healthy tissues still presents an unsolved problem.

During the frenzied haste for the use of higher potentials there also appears a return to low voltages and soft rays provided by contact-therapy machines. At first limited to very superficial lesions, contact therapy is now being used for thicker growths, often in body

cavities, as tumors of the tongue, tonsil, rectum, and uterus. The intensity of the source of radiation and the short distance permit, in a minimum of time, maximum necrotic effects. The depth of the necrotizing effect is not well known, but the effect is desired in treating cancers. This trend again places us in the midst of technical conditions analogous to those which prevailed in the early days of roentgen therapy, and this is something which the proponents of the method appear to have forgotten.

It would seem more logical to use a standard easily flexible tube at 100 kv., with a wide variety of treatment cones, permitting both external and intracavitary irradiation with long or short distances as desired and an easy choice of filtration; in addition, a larger area of tissue can thus be treated. Granted that the apparatus for contact therapy is easy of manipulation and that the treatment time is shortened, it is still possible with conventional apparatus to obtain a better distribution in depth and width and to increase absorption of the rays by a better distance.

From these general considerations it seems that roentgen therapy has evolved toward the use of both higher and lower potentials. This at first glance appears paradoxical, but what is really paradoxical is the use without due consideration of either potential, the use of these potentials having been justified by ease of application and by the desire to be modern and up to date. This type of reasoning cannot be justified. Good roentgen therapy requires different qualities of radiation and adequate filtration based upon the anatomic and biologic factors prevailing in each case.

The real superficial lesions limited to the skin may be healed by contact therapy or by rays of 80 to 100 kv.p. If the lesion is small, the advantage of contact therapy is speed in an active service; these lesions heal well, but when a thickness of 1 cm. is approached, the results are poorer because of insufficient penetration and frequently because of the small volume of irradiated tissue. In these instances the target-skin distance has been increased and filters have been added, so that contact therapy has become a "distance" therapy almost similar to the conventional type of treatment.

In intracavitary lesions, contact therapy is again unsatisfactory, because only the superficial layers of the tumor are destroyed. When 100 to 120 kv.p. are used with adequate filtration and a judicious distance, a much better distribution of radiation is achieved and much wider fields can be used. In subcutaneous lesions of slight depth, intermediate therapy is again superior to any other type of radiation.

Roentgen therapy at 200 kv.p. with one or two millimeters of copper filtration remains the most valuable weapon of the therapist. In lesions at any depth it permits a good tumor dose without skin damage. The higher potentials too frequently damage healthy tissues deeper than the tumor because of the Compton effect of the recoil electron. If it becomes possible to limit the effect of radiation selectively to the neoplastic cells, the high potentials will bring considerably more hope to roentgen therapy, but to date this has not been possible.

E. M. SAVIGNAC, M.D.
Detroit, Mich.

Low Intensity Radium Element Needles. C. L. Martin. Am.J. Roentgenol. 62:467–492, October 1949.

This is the Janeway Lecture, delivered before the meeting of the American Radium Society in 1949.

Although interstitial radium needle therapy originally fell into disrepute because of the high number of regional sloughs and painful reactions, it has regained a position of importance following the introduction of low-intensity needles with heavy metal filtration. The author uses needles having over-all lengths of 1.1, 2.7, and 5.1 cm., which contain 0.66, 1.33, and 2.4 mg. of radium sulfate respectively, the longer needles having loadings of 0.88 and 0.66 mg. per centimeter of active length. This is in accord with Paterson's observations that 0.33 mg. per centimeter is rather light and 1.0 mg. per centimeter is too strong. The filtration is at least 0.5 mm. of platinum or gold. These needles are left in place for seven days and have produced highly commendable results.

The author feels that radium needles have many advantages over radon seeds. Chief among them is the more even distribution obtainable with the longer radium implants. Also important is the fact that, if post-implantation films reveal a needle to be out of line, its position can be easily and quickly corrected. With most radon seeds used in this country, 9 per cent of the transmitted radiation consists of beta rays. It is believed that this contributes to undesirable reactions. Radon seeds can slip out of position as the tumor melts and, if used in intraoral work, may be aspirated. The needles, on the other hand, are firmly stitched in place so that they can be easily recovered. Furthermore, needles are removed following treatment, while seeds are often left behind as foreign bodies in the remaining scar.

The author has simplified the baffling problem of tissue dosages by placing the needles 1 cm. apart in standard patterns so that the cells lying between any two needles receive from 6,000 to 12,000 gamma roentgens in the standard time of seven days. If the size or shape of the tumor so demands, two or more patterns are employed, according to the judgment of the therapist. This has eliminated laborious calculations, but does not provide the uniform radiation of the Paterson-Parker system.

The technic of implantation, including preoperative and postoperative care is given.

Cancerous lesions of the face, neck, and ear, especially when measuring over 2 cm. in diameter and extending into the deep tissues, are suitable for treatment by the insertion of planes of radium needles following the preliminary removal of all fungoid projections and areas of necrosis. The author reports a 33 per cent five-year cure rate for advanced cutaneous cancer of the face and neck treated with radium needles. A 73 per cent five-year cure rate was obtained on large tumors of the canthi and a 33 per cent cure rate was obtained in 77 cases of lip cancer, 58 per cent of which had node involvement.

With the exception of bulky tumors located in the tongue, almost all cancers of the mouth can be converted into planes or combinations of planes for implantation, even though in some cases preliminary electrosurgery is necessary. Of a series of 218 patients, 40 per cent were well five or more years following implantation and in 63.7 per cent there was complete healing of the primary lesion.

Metastatic cervical lymph nodes are treated simultaneously with implanted radium needles and heavily filtered 220-kv. roentgen rays. This treatment has yielded a 27.3 per cent rate of five-year cures from a series of 146 cases, many of which were far advanced.

This is compared with Hayes Martin's five-year cure rate of 26 per cent, which was obtained by block dissection in a group of 65 selected cases (Ann. Surg. **114:** 972, 1941).

All cases of carcinoma of the cervix with parametrial involvement are treated with the combination of needles implanted within the parametrium and moderate external roentgen irradiation. No ureteral damage could be traced to this type of therapy.

Fifteen illustrations; 10 tables.

HARRISON SHAPIRO, M.D.
Mt. Sinai Hospital of Cleveland

Treatment of Large Birth Marks. E. Daubresse. J. belge de radiol. **32:** 175–181, 1949. (In French)

The author presents his method of treatment, in use since 1926, for large, rapidly spreading angiomatous tumors involving the face and neck of infants. He calls these birthmarks giant angiomata. Attention is particularly called to the wide extent of the birthmarks both in area and in depth, and to their rapid growth, which makes early treatment imperative.

The essential aim of treatment is, first, to arrest the process of development of the vascular tissue, and then to bring about total disappearance of the neoplastic tissue while maintaining the integrity of the normal tissues as perfectly as possible.

Surgery is completely out of question because it cannot avoid removing necessary structures in the face or neck. Carbon dioxide snow is also of no value because it can affect only the superficial tissues. Radiologic treatment is the only successful procedure and must be administered so that the tumor tissue regresses slowly and progressively. Rapid destruction of the tumor must be avoided because of necrosis with resulting unsightly scars. In the choice of radiologic methods radium is preferable to x-rays because a weak, slowly administered dose can be used much more easily, avoiding too brutal an effect on the tumor. The author uses molded skin applicators fashioned from Columbia paste. The sources of radium are of 2 mg. each, with filtration of 0.5 mm. of platinum, at a distance of 7 to 10 mm. from the skin. The total dose per treatment is spread over two, three, or four days and varies from 0.1 to 0.3 millicuries destroyed per square centimeter of irradiating surface. Each case must be judged on its own merits, making the dosage somewhat flexible. The author prefers to anesthetize his patients lightly with agents such as rectal avertin, permitting careful positioning of the applicators. Great care is taken to prevent the applicators from slipping by the generous use of immobilizing bandages. Subsequent treatments, if necessary, are given two, three or four months later.

Four photographs of two patients, showing excellent results, complete the article.

E. M. SAVIGNAC, M.D.
Detroit, Mich.

Radon Implantation for Acromegaly and Cushing's Syndrome. D. W. C. Northfield. Proc. Roy. Soc. Med. **42:** 845–853, October 1949.

The author presents a series of five case reports, relating the results of implantation of radon in four cases of pituitary basophilism and one of acromegaly.

The first patient with basophilism failed to respond to estrin or x-ray therapy (1,000 r). Two radon seeds were then inserted into the pituitary gland, for a total dose of 3.0 mc. The response was rapid and dramatic, and the patient has continued in good health for nine years.

The second case of basophilism was treated similarly. The response was much slower and less complete, but the degree of improvement was considered satisfactory.

The third patient was an acromegalic. At operation a very vascular, unexpectedly extensive tumor was found, and 9 mc. of radon were inserted into the mass. Edema of the brain ensued and, despite wide decompression, the patient died.

The next patient underwent radon implantation when x-ray therapy to the sella for clinical basophilism proved of no avail. Results were fair; the patient lost a little weight, hairiness of the face was less, and there was an occasional menstrual period.

The last case was also one of basophilism. The patient did poorly following the radon implantation procedure and presented the clinical picture of acute pituitary cachexia. A ventriculogram demonstrated general ventricular dilatation, which could have been caused by diffuse cerebral atrophy secondary to irradiation. Obstructive hydrocephalus incident to posterior fossa adhesions was also considered, particularly since a previous lumbar encephalogram was unsuccessful. Dye was then introduced into the ventricles, followed by lumbar puncture in an effort to recover it, but none was present up to one hour. The patient suddenly died. Due to a "most unfortunate error," methylene blue instead of phenolsulphonephthalein was used in the dye study; it was felt that this was undoubtedly responsible for an irritative ependymitis which hastened if it did not actually cause the fatality.

No definite conclusions are drawn by the author, except that he is "skeptical whether radon implantation is indicated in a patient who has radiographic enlargement of the sella, indicating a frank intrasellar tumor."

Twenty-one illustrations, including 3 roentgenograms.

EDWARD E. LEVINE, M.D.
Dearborn, Mich.

Radiotherapy in the Treatment of Pituitary Basophilism and Eosinophilism. Frank Ellis. Proc. Roy. Soc. Med. **42:** 853–860, October 1949.

Before directing entire attention to the pituitary gland in clinical basophilism, one must exclude the possibility that the signs and symptoms are due to cortical adrenal tumor or thymic tumor, which in themselves could be associated with the syndrome. A cortical adrenal tumor or thymic tumor may cause Cushing's disease by a secondary effect on pituitary basophile cells in the absence of an actual basophilic adenoma. It is necessary, therefore, to deal with the underlying primary pathological disturbance. The author does not recommend a major thoracic exploration if a thymic tumor is not visible on the roentgenogram, but he does feel that, when doubt exists, adrenal exploration is essential before exploring and needling the pituitary gland.

Before proceeding with definitive treatment directed to the pituitary gland, some of the milder cases might better be left alone, since a fair percentage of patients improve spontaneously when untreated.

With regard to types of therapy in basophilism, x-ray

therapy is disappointing; radon insertion is much more dangerous, but the results are more gratifying. If x-ray therapy is to be used, the author recommends 4,500 r total dose at the pituitary, over a period of four weeks.

As regards eosinophilic adenoma, the results indicate an encouraging response to irradiation; 3,000 r to the pituitary will cause improvement in two-thirds of the cases. With higher doses results are less favorable. Headache and diabetes mellitus usually show little improvement. Visual symptoms, however, are frequently eliminated; the patients get stronger and feel generally better, menses may return, and the libido may be restored after a relatively long time.

The author describes his precise technic for irradiating the pituitary gland, and the paper concludes with an exceedingly interesting case history of acromegaly as described by the patient.

Six tables. EDWARD E. LEVINE, M.D.
Dearborn, Mich.

Treatment of Cancer of Breast by Simple Mastectomy and Roentgenotherapy. Robert McWhirter. Arch. Surg. **59:** 830–842, October 1949.

Patients treated at the Royal Infirmary of Edinburgh, Scotland, over the two five-year periods, 1935–40 and 1941–45 were compared statistically. The treatment in the first period was radical mastectomy, including dissection of the axilla; in the second period, simple mastectomy plus postoperative irradiation with a minimal tumor dose of 3,750 r in three weeks, using 250 kv. and a half-value layer of 3.7 mm. copper. For operable cases, the five-year survival in the first group was 50.1 per cent, compared with 62.1 per cent in the second; for all cases referred, without regard to stage of disease, the respective survival rates were 32.4 per cent and 43.7 per cent. As both series were large, consisting of 790 and 1,345 patients respectively, these results are highly significant. Moreover, these patients constituted a very large percentage of those suffering from breast cancer in southeast Scotland. The author therefore advocates simple mastectomy plus adequate postoperative irradiation as the proper basic treatment for all breast cancer, even early, with other forms of treatment to be used only for exceptional indications.

[While the statistical methods used differ slightly from those usually accepted for such an analysis, there can be no question that the conclusions are based on thoroughly sound evidence; this is a highly significant contribution See also a paper by the same author in Am. J. Roentgenol. **62:** 335, 1949.—L. G. J.]

Three drawings; 6 tables.

LEWIS G. JACOBS, M.D.
Oakland, Calif.

Radiotherapeutic Technique of Palliation in Late Cancer of the Breast. John R. Nuttall. J. Faculty of Radiologists **1:** 98–102, October 1949.

Palliative radiotherapy in mammary cancer may be said to begin when deep fixity of the primary lesion or of the secondary nodes has rendered radical operation impracticable and hope of permanent cure remote. Two objects are to be considered: to lengthen life or to relieve some distressing sign or symptom.

The decision to give palliative radiotherapy in the advanced case calls for consideration of the following questions:

(1) What sign or symptom is most distressing to this patient?

(2) What therapeutic agent that offers a good chance of relieving this distressing symptom is available?

(3) Will the proposed treatment be more intolerable than the disease?

(4) Will the treatment occupy a disproportionate part of the patient's reasonable expectancy of life?

(5) Will the proposed treatment produce undesirable "late" effects that need to be considered in an advanced case?

The various metastases and secondary growths which occur in late carcinoma of the breast are discussed, as well as methods for palliation or eradication with both radium and x-rays. D. R. BRYANT, M.D.
The Henry Ford Hospital

Treatment of Advanced Breast Cancer. A. J. Durden Smith. J. Faculty of Radiologists **1:** 103–106, October 1949.

Three groups of breast carcinomas call for palliative treatment: cases of Stage III and Stage IV and postoperative recurrences. Cancers of Stage I and II are best treated by radical surgery, with or without irradiation.

The aims in palliation should be: (1) to heal fungation or at least get rid of it; (2) to prevent imminent fungation; (3) to relieve pain; (4) to prolong life; (5) to assure the patient that something is being done.

Some cases of Stage III cancer may fulfill the criteria of operability within three months after extensive radiotherapy. At the author's hospital, these cases are operated upon, but he feels that this method may be unwise, since the patients show poor wound healing and considerable restriction of arm motion postoperatively. It may be that this problem would better be solved by immediate post-irradiation radical mastectomy, when the tissues are in better shape.

A surgical procedure which is of considerable value in palliation is the toilet operation, that of resecting a large fungating mass and thereby relieving both the patient and her family of a considerable burden.

D. R. BRYANT, M.D.
The Henry Ford Hospital

Palliative Treatment for Advanced Breast Cancer. G. W. Blomfield. J. Faculty of Radiologists **1:** 107–111, October 1949.

The author gives an analysis of 848 cases of breast cancer referred to his hospital for palliative therapy, 193 of whom received treatment. Sixty-one per cent of these patients actually derived some palliation from their therapy. Five patients were well and clinically free from growth three years after treatment, and 10 were clinically clear of disease up to two years or more. The patients receiving the greatest benefit from palliation fell into three categories: (1) those with local recurrences at or near the site of operation, (2) those with skeletal metastases, (3) those with extensions or metastases in the axillary or supraclavicular nodes.

Carcinoma of the breast in the pregnant woman is notoriously malignant and, if discovered early enough in pregnancy, is indication for therapeutic abortion.

It is notable that patients with advanced breast cancer may show little change for a considerable period of time and then quite suddenly deteriorate and die with widespread metastases.

The author presents a graph demonstrating the com-

parative rapidity in growth of the primary tumor and the metastases. The growth in general is progressively more rapid in first and second generation metastases.

One table; 2 photographs; 1 chart.

D. R. BRYANT, M.D.
The Henry Ford Hospital

Rotation Treatment of Cancer of the Esophagus. A Clinical Material. Carl Krebs, Howard Nielsen, and Poul E. Andersen. Acta radiol. **32:** 304–316, Oct. 31, 1949.

The authors present a critical analysis of 217 cases of cancer of the esophagus and cardiac portion of the stomach, treated with a rotation technic. They use a rotating chair in which the patient is immobilized, the tumor to be irradiated being placed in the axis of rotation. The location of the tumor is ascertained by fluoroscopy. The treatment factors are: 170 kv., 0.5 mm. Cu filtration, 0.7 mm. Cu h.v.l., 50 cm. target-axis distance. The depth dose is calculated on the basis of the isodose curves described in Howard Nielsen's thesis (Copenhagen, 1948) and previous publications by other authors.

The authors strive for a tumor dose of 5,000 to 6,000 r in the course of thirty to forty days, which corresponds to approximately 15,000 r measured in air. The rotation treatment, *per se*, is a rather strenuous procedure, and it is considered expedient to improve the general condition of the patients as far as possible by means of blood transfusions, administration of extra vitamins (especially vitamin B complex), liver preparations, glucose saline solution parenterally or rectally, amino acid preparations, etc. Compared to an average duration of life of approximately five months after diagnosis with previous methods of therapy, the average duration of life in the present rotation therapy series was approximately eight months. About a third of the patients died within the first three months, half within the first six months, and almost 80 per cent within the first year. During the second year another 10 per cent died. A large proportion of the patients who died within the first six months were very debilitated, often almost moribund on admission. Most of this group received only a few treatments, and the majority died within a month.

The authors point out the importance of the site of the tumor. There is a wide difference between the duration of life of patients with a tumor localized in the esophagus and that of patients with cancer of the cardio-esophageal junction. In the latter category only 11 per cent survive more than one year, while 15 to 25 per cent of the patients with esophageal involvement were still alive after that period.

Although the actual curative effect of the rotation therapy has not been very considerable, nevertheless some prolongation of life has been obtained. The palliative effect must also be considered, the more so because the patients presenting themselves for treatment are in such a state of general disability and poor nutrition owing to pain and difficulty in swallowing. It has been possible at the end of treatment to make the roentgenographically demonstrable changes disappear completely or regress to a considerable extent in about two-thirds of the patients. There is a corresponding relief of difficulty in swallowing.

One photograph; 1 table.

E. S. KEREKES, M.D.
University of Arkansas

An Unusual Localization of Hodgkin's Disease. Hodgkin's Disease of the Stomach Treated Radiologically. A Case Report. E. Daubresse. J. belge de radiol. **32:** 170–174, 1949. (In French)

The author has discovered in the literature 7 cases of Hodgkin's disease involving the stomach. All were treated successfully by x-rays, with one eight-year and one ten-year survival.

The author's patient was a white female who was first seen at the age of thirty-five and was treated by deep roentgen therapy for multiple localizations of Hodgkin's disease over a period of ten years before her death at the age of forty-five. The localizations of the disease during this period were varied and were frequently intra-abdominal. There was always a favorable response to radiation until the final episode. Two years before her death the patient experienced considerable difficulty in eating and had an epigastric mass the size of a newborn infant's head. Roentgen examination showed a large gastric tumor, which disappeared rapidly under roentgen therapy so that a subsequent stomach examination was normal. There was a recurrence of the gastric tumor six months later, which was again made to disappear by roentgen therapy, without further recurrence. One and one-half years later the lungs, liver, and spleen were extensively infiltrated, and death ensued.

Eight roentgenograms.

E. M. SAVIGNAC, M.D.
Detroit, Mich.

Diagnosis and Therapy of Bone Tumors. A. Zuppinger. Fortschr. a. d. Geb. d. Röntgenstrahlen **71:** 373–394, July 1949. (In German)

While in the diagnosis of bone tumors the x-ray examination plays a dominating part, other means helpful in the differential diagnosis should not be neglected. Of particular value are the history and duration of the pathologic process, urinalysis (especially in myeloma), subfebrile temperatures and leukocytosis (especially in Ewing's tumor and occasionally in osteogenic sarcoma), blood sedimentation tests, and electrophoretic albumin determinations on the blood serum. In all cases thoracic radiography and a Wassermann test are indispensable. Sternal puncture is indicated in suspicion of myeloma. Exploratory tumor drill and puncture have been generally abandoned in favor of exploratory excision and biopsy, although this procedure may involve the potential dangers of infection, delayed or deficient wound healing, or, at least theoretically, tumor dissemination. While the latter danger may be combated by preceding irradiation, the former dangers may be averted by antibiotics and chemotherapy.

Zuppinger, though emphasizing the possibility of error in the histologic tumor diagnosis, does not share the opinion of Glauner and others who consider the radiologic tumor diagnosis superior to the pathologic findings obtained through biopsy. The value of serum phosphatase reactions is stressed, especially in the presence of osteoplastic metastases, where in about two-thirds of the cases increased alkaline phosphatase values are observed; with osteolytic metastases, this phenomenon is present in less than one third of the cases. The fact that in a few cases decomposition of apatite could be proved, suggests to the author the possibility of the existence of an osteolytic enzyme or ferment in the blood serum.

Different pathologic and radiologic (clinical) classifications of bone tumors are discussed, especially a new and as yet unpublished classification by von Albertini, who makes a principal differentiation between tumors of osteogenic origin and those of myelogenic origin.

The different benign and absolutely and conditionally malignant bone tumors are discussed in detail with reference to their radiodiagnostic features and irradiation indications. The benign tumors are as a rule treated by operation. Of conditionally or potentially malignant neoplasms, giant-cell tumors generally respond well to irradiation unless the bone destruction is too extensive. However, continuous supervision is necessary. Adamantinomas and chondromas, although accessible to radiotherapy, should be treated surgically if possible; a combination of operation and irradiation is probably the treatment of choice. Of malignant tumors, Ewing's sarcoma should be treated by radiotherapy, which in the author's experience results in a three-year survival in about one-fourth of the cases. In osteogenic sarcoma, the administration of sufficiently high radiation dosages may produce considerable shrinkage of the tumor or, in rare instances, even complete disappearance, although the final unfavorable prognosis is little affected by any therapy, even the most radical surgical procedures. The radiologic detection of metastases frequently saves the patient from hopeless and mutilating operations. In myeloma, good palliative results are often obtained by radiotherapy.

Thirty-four roentgenograms; 3 tables.

ERNST A. SCHMIDT, M.D.
Denver, Colo.

Carcinoma of the Ovary. Malcolm S. Allan and Arthur T. Hertig. Am. J. Obst. & Gynec. **58:** 640–653, October 1949.

A complete analysis is made of 265 malignant ovarian tumors treated over a forty-three-year period, 1903–45, in the Free Hospital for Women, Brookline, Mass., with special attention to pathology. Since 1930 many cases have been treated with deep x-ray therapy in addition to operation, and this is now a routine procedure. The dose has varied from 3,000 to 9,000 r, but technical factors are not specified.

Tabulation of the results shows considerable improvement in the percentage of five-year and ten-year survivals when irradiation was given, but the fifteen-year percentages are identical. This tends to confirm observations by Pemberton (Am. J. Obst. & Gynec. **40:** 751–763, 1940) and others that radiation therapy increases longevity and comfort of the patient but does not necessarily cure the disease.

Twenty-three tables.

Contribution to the Study of Sarcoma of the Synovial Membrane. V. Hoenig. Acta radiol. et cancerol. bohemoslov. **4:** 1–21, 1949. (In French)

The membranes lining the articular cavities, synovial bursae, and tendon sheaths belong, from an embryologic point of view, to the same group, *i.e.*, to the group of synovial membranes. Seven cases of sarcoma involving these membranes are presented, following which the origin, evolution, and treatment are discussed. The tumor arises from the pluripotential synovioblast. In addition to a groundwork of rounded or spindle cells, there are epithelioid gland-like spaces containing mucus, so that a diagnosis of carcinoma may be made erroneously.

The evolution of the disease is sometimes very slow (up to sixteen years). Nevertheless, local recurrence after removal and hematogenous dissemination, especially to the lungs, occur in the majority of cases. The final prognosis is always doubtful; it is not dependent upon the histologic structure. Two of the author's patients are alive six years after local excision, but amputation is the treatment of choice. Radiotherapy is without benefit.

Four photomicrographs.

CHARLES NICE, M.D.
University of Minnesota

Synovioma: A Case Report with Pulmonary Metastases that Regressed Following Irradiation. R. D. Williams and H. W. Mahaffey. Ohio State J. Med. **45:** 988–990, October 1949.

Although synovioma is usually considered highly resistant to irradiation, pulmonary metastases in the case reported here showed remarkable regression in response to 2,000 r delivered to each of four areas over the chest. Considerable clinical improvement also took place. Five months later the chest picture remained unchanged, but three months after this death ensued.

The patient was first seen in 1943, at the age of 35, with a soft red swelling on the medial aspect of the right foot. Some fourteen years earlier the right great toe had been amputated for what was then diagnosed pathologically as angio-endothelioma. Biopsy on the present occasion led to a diagnosis of synovioma, though one pathologist considered the lesion an hemangio-endothelioma, which suggests its identity with the earlier tumor. Irradiation was instituted, but after receiving 900 r on the medial and 600 r on the lateral aspects of the foot the patient failed to return for further treatment. When he was again seen, four and a half years later, he had undergone amputation of the right leg below the knee. A tumor was now present in the soft tissue above the right iliac crest, and both lung fields were studded with nodular densities. As stated above, the lung lesions yielded to irradiation, but the tumor above the iliac crest increased in size, and similar masses appeared on the posterior aspect of the thigh. At autopsy, metastatic tumor nodules were found in the heart, lungs, liver, spleen, left kidney, and brain. Microscopically these tumors had the typical structure of synovial sarcoma.

Two roentgenograms; 1 photomicrograph.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Role of Low-Dosage Irradiation in Selected Cases of Menstrual Disorders. Glenn S. Edgerton. South. Med. & Surg. **111:** 303–305, October 1949.

Low-dosage irradiation is not a cure-all for menstrual disorders but should be offered to carefully selected patients who have had proper gynecologic study and evaluation. Irradiation of the ovaries, pituitary, and spleen should be administered according to the technic described by Kaplan (New York State J. Med. **46:** 2746, 1946. Abst. in Radiology **49:** 656, 1947). Increasing the dosage or altering the method of treatment does not increase the benefits.

Six cases are reported. Regular menstrual periods followed irradiation in all but one instance. In this patient the amenorrhea was thought to be due primarily to ovarian rather than pituitary failure.

Use of Radium in Treatment of Hypertrophic Lymphoid Tissue in the Nasopharynx. Charles H. Dow. Arch. Otolaryng. **50:** 417–428, October 1949.

During the year Feb. 1, 1947, to Feb. 1, 1948, the radium sulfate applicator was used to destroy hypertrophic lymphoid tissue in the nasopharynx of 74 patients at the Gill Clinic, Roanoke, Va. Forty-one patients were treated by placing the monel metal applicator containing 50 mg. radium sulfate eight and one-half minutes to each side of the nasopharynx. Thirty-five of this number received three treatments at two-week intervals; 6 patients had but one treatment and did not complete the series. Thirty-three patients were treated in a similar manner except that the time to each side of the nasopharynx was extended to twelve minutes. Twenty-three patients in this group were given three treatments at two-week intervals; treatment was still not completed at the time of the report in 9 patients, and one patient interrupted his series. A comparison of the results shows that the longer treatment removes lymphoid tissue safely and more effectively.

Two tables.

RADIOISOTOPES

Symposium on Radioactive Isotopes. J. Clin. Investigation **28:** 1274–1385, November 1949. **Production and Availability of Radioisotopes.** Paul C. Aebersold. pp. 1247–1254. **Use of Stable Isotopes in Biological and Medical Research.** Irving M. London. pp. 1255–1270. **Dosage Determination in the Use of Radioactive Isotopes.** Leonidas D. Marinelli. pp. 1271–1280. **Personnel Protection in the Use of Radioactive Isotopes.** G. Failla. pp. 1281–1285. **Biological Hazards and Toxicity of Radioactive Isotopes.** Austin M. Brues. pp. 1286–1296. **Equations for Tracer Experiments.** A. K. Solomon. pp. 1297–1307. **Therapeutic Application of Radioactive Phosphorus with Special Reference to the Treatment of Primary Polycythemia and Chronic Myeloid Leukemia.** Hymer L. Friedell and John P. Storaasli. pp. 1308–1323. **Radioactive Phosphorus in Studies on the Metabolism of Normal and Neoplastic Tissues.** A. Marshak. pp. 1324–1329. **Use of Radioactive Iodine in Studying the Pathologic Physiology of Thyroid Disease.** Rulon W. Rawson. pp. 1330–1346. **Use of Radioiodine in Physiological and Clinical Studies on the Thyroid Gland.** M. S. Raben and E. B. Astwood. pp. 1347–1366. **Radioiodine Therapy in Graves' Disease. A Review.** Mayo H. Soley and Nadine Foreman. pp. 1367–1374. **Uptake and Elimination of Krypton and Other Inert Gases by the Human Body.** C. A. Tobias, H. B. Jones, J. H. Lawrence, and J. G. Hamilton. pp. 1375–1385.

According to *Aebersold*, not only are radioisotopes available in amounts many times the prewar quantities but also as a much greater variety of radioelements. Nearly all the biologically useful radiosotopes, including such important ones as radiohydrogen (tritium, H^3), radiocarbon (C^{14}), radiophosphorus (P^{32}), radiosulfur (S^{35}), radiocalcium (Ca^{45}), radioiodine (I^{131}), etc., are produced routinely. Further, a stock of isotope-labeled compounds is available for the first time. Many complex organic molecules have been labeled or tagged with isotopes and many more will become available in the near future.

Before the war, little more than a dozen institutions were routinely using radiophosphorus and radioiodine in diagnosis and therapy. Today 80 different institutions are employing either or both of these isotopes in diagnostic and therapy procedures and in research investigation.

London states that, despite the relatively short period during which isotopes have been available, tracer technics have exerted a pervasive influence on biochemical thought and practice. A definitive evaluation of this influence may have to await more extensive development of isotop investigation. It is possible, however, to indicate two principal developments in biochemical thought, due in part to the impact of tracer technics, namely a concept providing insight into the mechanisms of biological synthesis, and the concept of the dynamic state of the body constituents. The experimental basis and theoretical implications of the latter, which includes an appreciation of the kinetics of biochemical reactions, represents a major advance toward a thorough understanding of the processes which occur in the living cell.

When radioactive isotopes are employed either as tracers or in therapy, it is important to be able to determine the radiation dosage. This cannot, in general, be measured, but when the half life, radiation energy, and biological uptake and excretion are known, it can be calculated. Since the basic information regarding disintegration schemes and energies is scattered through many journals, *Marinelli* has collected pertinent data here. Two extensive tables are presented, for beta and gamma rays respectively, giving half life, radiation average energy, fraction disintegrating per day, and specific dosage data, including the safe tracer concentration, for some 33 isotope elements.

Failla emphasizes that every worker with radioactive substances must be made to realize that radiation injury may not become apparent or serious for many years. Each worker should accept the permissible limits of exposure set by competent authorities and should strive by all possible means to keep his exposure well below these limits at all times. Protection from both gamma and beta rays is discussed. Permissible limits of exposure to ionizing radiation recommended by the Committee on Radiation Protection are: (1) for whole body exposure to x- or gamma rays up to three million volts, 0.3 r per week measured in air; (2) for local exposure essentially limited to the hands, 1.5 r per week or 1.5 rep per week in the case of beta rays, in both cases measured at the basal layer of the epidermis, which in general may be assumed to be at a depth of 7 mg./cm.^{2} below the surface of the skin.

According to *Brues*, the effects of large dosages of radioisotopes resemble to a marked extent those of total-body irradiation, with modifications dependent on tissue distribution. Permissible exposure levels are determined by the late or chronic radiation changes, of which malignant changes have quite properly attracted major attention.

There is no evidence to indicate that radiation dosages to tissue corresponding to established "permissible" external dosages (0.3–0.6 rep/week) will result in an increased incidence of malignant disease detectable in a

population of moderate size. In making such calculations, it is necessary to estimate maximum local tissue dosage, rather than the mean value for an organ or structure, and to make use of factors recognizing the greater effectiveness of ionization in areas where it is dense (*e.g.*, alpha-particle ionization).

The suggestion is made that a more conservative figure is desirable where a large population may be affected, and the basis for using large dosages in clinical investigation, diagnosis, and therapy is discussed.

Bone tumor induction by Sr^{89} has been studied extensively in mice. The data are consistent with the view that each given quantity of radiation to bone confers a given probability of bone tumor formation which may occur at any time following a "latent period." The latent period increases gradually with the dosage. It is not known at present whether a threshold exists for such effects.

Solomon presents in detail equations covering five common cases of the use of isotopes in biological and physiological systems. They are: (1) simple decay; (2) uptake from a constant source; (3) closed two-compartment system; (4) diffusion or flow out of a compartment; (5) uptake of radioactive material in a three-compartment system.

Friedell and Storaasli review the rationale for using P^{32} as an internally distributed source of radiation and its selective uptake by various normal and tumor tissues. The basis of this, which rests on experimental, biological, and clinical work, is discussed.

The pertinent information necessary to apply P^{32} effectively, together with experimental and clinical data, is presented. The physical characteristics of P^{32} and its behavior biologically are included.

Primary polycythemias and chronic myeloid leukemias are effectively treated with radioactive phosphorus. Ten cases of primary polycythemia and 15 of chronic myeloid leukemia are reported, the details being presented in tabular form. P^{32} has also been used for a variety of malignant conditions other than leukemia. None of the responses have been striking. Mention is made of possible beneficial application to widespread metastases to bone from carcinoma of the breast.

Marshak confines his discussion of the use of radioactive phosphorus in studies on the metabolism of normal and neoplastic tissues to those aspects of the subject which have not been fully presented elsewhere or in which his interpretations differ from those of other writers. The following subjects are considered: phosphate esters and carbohydrate metabolism, nucleic acids and nucleoproteins, nucleic acid turnover in relation to mitosis, x-ray effect on nucleic acid turnover, and deposition in bone.

Rawson states that studies with radioactive iodine have resulted in major contributions to our knowledge of thyroid physiology, normal and morbid. Thus far the completed studies are in harmony with previous observations made with the conventional biochemical technics. However, because of the fact that with these technics physiologic levels of study never before obtained are possible, there has been a broadening of our knowledge of thyroid disease at a level which could not otherwise be reached.

With these technics better concepts have been provided as to (1) the actions of certain thyroid stimulators and inhibitors, (2) the function and biology of benign and malignant neoplasms of the thyroid, (3) a possible mode of action of the thyroid hormone on the tissues of the body. It is suggested that these studies are only the beginning of new and intensive investigations on normal and morbid physiology of the thyroid which will not only lead to better understanding of thyroid disease but may also result in more intelligent and physiologic therapy of these maladies.

Raben and Astwood review the literature (134 references) on the use of radioiodine in physiological and clinical studies of the thyroid gland under the following headings: (1) evidence for physiological identity of radioiodine and I^{127}; (2) absorption, distribution, and excretion of iodide ion; (3) concentration of iodide ion by the thyroid; (4) organic binding and hormone synthesis (iodine compounds in the thyroid, iodination mechanism, conjugation, extra-thyroidal hormone formation, action of antithyroid compounds, inhibitory effect of iodide, studies using the radioautographic technic); (5) hormone secretion ("proteolytic enzyme," protein-bound iodine of the plasma); (6) factors influencing the rate of hormone formation and discharge; (7) the fate of thyroxine in the body; (8) radioiodine in clinical investigation and diagnosis.

Soley and Foreman attempt to present the total experience, to date, in the treatment of thyrotoxicosis with radioactive iodine. Although there are differences among various groups as to the methods of treatment, the end-results are quite similar and compare favorably with already accepted forms of therapy.

The use of radioactive materials in clinical medicine brings with it the necessity for specially trained personnel and strict attention to the potential hazards of radiation both to patients and physicians. In this, the relatively young era of isotope application, progress must be made slowly and carefully. It is not unlikely, however, that radioiodine therapy ultimately will come into more general use.

Tobias and his associates studied the rate of change of radioactive krypton concentration in the extremities of young male subjects. The technics and results reported suggest that radioactive gases have applications in the study of the circulation to the extremities in the living patient and in numerous problems of gas exchange in normal and pathologic states.

The Clinical Use of Radioactive Phosphorus in the Surgery of Brain Tumors. Bertram Selverstone, William H. Sweet, and Charles V. Robinson. Ann. Surg. **130:** 643–650, October 1949.

Previous studies by the authors and others (see Selverstone and Solomon: Tr. Am. Neurol. A., 1948, pp. 115–119) indicated that P^{32}, because of its chemical, metabolic, and physical characteristics, was an ideal substance for the localization of brain tumors at operation, showing a greater concentration in tumor tissue than in normal brain.

In order to measure the activity of the tumor tissue concentrating P^{32}, it was necessary to develop a Geiger-Müller counter which could be used as a probe within the brain and one which would be applicable to this use during neurosurgical procedures. Such a counter was developed, approximately the size of a ventricular needle, and has apparently been satisfactory in the cases studied.

The patient receives a single intravenous injection of buffered radioactive phosphate ion of from 0.95 to 4.2 millicuries preferably at least twenty-four hours before operation. The usual standard methods of brain tumor localization are fully utilized and the neurosurgical

exposure is made. A "control area" is first chosen, usually at the periphery of the exposed brain field, in a region considered least likely to be the site of the tumor. The sensitive volume of the counter is introduced into the brain, and the count is recorded at various depths beneath the surface. The counter is then employed in the suspected regions in a similar manner until a sharp increase in the counting rate indicates that the neoplasm has been struck. After the tumor has been located in this manner, successive approaches are made from the normal brain toward the tumor in an attempt to demarcate its boundaries.

The authors cite 33 cases in which this method was used to localize intracranial tumors. Data adequate for localization were obtained in 29 cases, in 23 of which the tumor did not present on the surface. In 12 of these cases, the data obtained in the counting procedure were employed in an attempt to demarcate the tumor in order to facilitate its radical removal.

Difficulties were apparent in instances of small deep masses and in diffuse gliomatosis in which no "normal control area" could be employed. The method may be a distinct aid in the localization and particularly the demarcation of lesions in which a total extirpation may be attempted.

Three photographs; 4 tables.

H. D. KERMAN, M.D.
Louisville, Ky.

The Use of Radioactive Isotopes in the Study of Peripheral Vascular Disease. Frederick W. Cooper, Jr. South. M. J. **42:** 870–873, October 1949.

A method has been devised in which minute quantities of radioactive sodium chloride can be injected into the deeper tissues of the extremities, and the rate of disappearance or removal of the sodium chloride from the part can be accurately recorded by means of electronic devices. This has been described elsewhere (Surg. Gynec. & Obst. **88:** 711, 1949. Abst. in Radiology **54:** 799, 1950). Briefly it is as follows:

A radioactive salt solution, consisting of 10 microcuries of radioactive sodium chloride in 0.1 or 0.2 c.c. of solution is injected into the gastrocnemius muscle, which has been positioned over a Geiger-Müller tube, with the patient's extremities elevated at a 30° angle. The Geiger-Müller tube is connected with an electromechanical recording device which automatically indicates the rate at which the radioactive salt is being mobilized and removed from the region under observation. It is believed that this method should prove of value (1) for more accurate determination of the site of amputation in the presence of vascular disease; (2) for the diagnosis of vascular disease; (3) for evaluation of various forms of medical and surgical therapy to which a patient has been subjected.

Four charts.

ROBERT LEAMING, M.D.
Jefferson Medical College

Thrombocytopenic Purpura Complicating Radioactive Phosphorus Treatment in a Patient with Polycythemia Vera. Gould A. Andrews. Am. J. Med. **7:** 564–568, October 1949.

The author reports a case of polycythemia vera which was treated by multiple phlebotomies, roentgen irradiation, and radioactive phosphorus, with the subsequent development of thrombocytopenic purpura. The patient received 60 r to each of four fields over the anterior and posterior trunk in nineteen days, and three weeks later 200 r to each of six small fields over the spine, sternum, and extremities. Three months after this, she was given approximately 8.4 mc. of radioactive phosphorus intravenously. The red blood count was still definitely elevated; the platelet count at this time was only 117,000. About five weeks later extensive ecchymoses and purpuric lesions were present, and there was a continuous gradual bleeding from the nose. Blood studies showed a fall in the red and white cell count; platelets were almost absent. A sternal puncture demonstrated a relative increase in plasma cells and megakaryocytes with striking morphologic changes.

The author concludes that radioactive phosphorus should be used with caution, especially in patients who already have thrombocytopenia.

Four photomicrographs; 1 graph; 1 table.

HOWARD L. STEINBACH, M.D.
University of California

Use of Radioactive Silver for the Detection of Abscesses and Tumors. I. The Concentration of Ag^{111} in Spontaneous and Experimentally Induced Abscesses. Harold D. West, Alfonso P. Johnson, and Charles W. Johnson. J. Lab. & Clin. Med. **34:** 1376–1379, October 1949.

Five albino rats had infections experimentally induced by *Streptococcus hemolyticus* injection. When 0.5 c.c. of the isotope of silver, Ag^{111}, having a half-life of 7.5 days, was injected into these animals, postmortem studies showed a high concentration of the isotope in the areas of infection. A lesser concentration found in liver and feces was interpreted as evidence that the isotope is excreted by the liver into the bile and thence to the feces. It is suggested that Ag^{106}, an isotope with a half-life of 8.2 days, which is a gamma ray emitter, be used in conjunction with a directional Geiger-Müller counter for the external detection of hidden foci of infection.

Three tables.

CORNELIUS COLANGELO, M.D.
Chicago, Ill.

Biologic Studies with Arsenic^{76}. III. Effect of Arsenic^{76} Upon the Clinical Course of Patients with Tumors of the Hematopoietic Tissues. Matthew Block, Leon O. Jacobson, and William Neal. J. Lab. & Clin. Med. **34:** 1366–1375, October 1949.

As^{76}, a radioisotope of arsenic having a half-life of 26.8 hours and emitting beta and gamma rays, delivers an estimated 1 r of total body radiation per millicurie. Intravenous injections were given to a group of 24 patients with disease of the hematopoietic system in total doses ranging from 12 to 88 mc., more recently treated patients receiving single doses of as much as 90 mc. The 24 cases included 2 of acute leukemia, 3 of subacute myelogenous leukemia, 6 of chronic myelogenous leukemia, 4 each of subacute and chronic lymphatic leukemia, 1 each of polycythemia vera, 2 of multiple myeloma, and 1 each of mycosis fungoides and carcinoma metastatic from gastric cancer.

The ability of the patient to lead a more comfortable and useful life was considered the best index of response to treatment, and on this basis the authors reached the following conclusions:

As^{76} was possibly favorable in subacute lymphatic leukemia, and worthy of further evaluation in multiple

myeloma. Radioactive arsenic therefore offers no advantages over x-ray, radiophosphorus, urethane, nitrogen mustard, radiosodium, Fowler's solution, and the folic acid antagonists such as aminopterin in the treatment of the diseases included in this survey.

A noteworthy feature was the flare-up occasioned by the treatment in previously quiescent cases of tuberculosis.

Three charts; 1 table.

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Use of Radioactive Lysine in Studies of Protein Metabolism. Synthesis and Utilization of Plasma Proteins. L. L. Miller, W. F. Bale, C. L. Yuile, R. E. Masters, G. H. Tishkoff, and G. H. Whipple. J. Exper. Med. **90:** 297–313, Oct. 1, 1949.

The authors are interested in protein metabolism, blood protein production and exchange, body protein needs as sustained by plasma protein or hemoglobin given parenterally, and the labile exchange between reserve protein stores and circulating plasma proteins. Availability of racemic lysine labeled with radioactive carbon^{14} in the epsilon carbon position made it possible to study not only the incorporation of this essential amino acid in the various body proteins, but also to follow the time course of the isotopically labeled blood proteins. In addition, the apparent rate of disappearance of the labeled plasma proteins injected into normal recipient animals was studied in an attempt to define the comparative behavior of the plasma albumin and globulin fractions.

Some of the authors' conclusions are as follows:

As a whole, plasma proteins are utilized and replaced at a rate of at least 10 per cent per twenty-four hours. This minimum rate is substantially faster than turnover rates commonly accepted and emphasizes the role played by the plasma proteins in the protein economy of the body. The exact rate of determination is made uncertain by the lack of knowledge of the magnitude of the amount of protein in solution in extracellular and lymph spaces and its rate of equilibrium with circulating plasma proteins.

From transfusion studies it is apparent that plasma globulin is metabolized at a significantly faster rate than plasma albumin. This is confirmed by the observation that following the feeding of dogs by labeled lysine, carbon^{14} is first incorporated in globulin in high concentration, but that later it also disappears more rapidly from the globulin fraction.

From their data the authors suggest that the period of bone marrow maturation of the red cell, during which time its related hemoglobin is synthesized, does not exceed three to five days.

The liver, kidney, pancreas, and spleen all have high values for carbon^{14} in twenty-four hour and seventeen-day experiments. The value in the gastro-intestinal tract is significantly high in the twenty-four-hour experiments. This is particularly true in the duodenum. Some authors have concluded that a high concentration in the duodenum of the labeled material fed was referable to its functional activity in both secreting enzyme proteins and probably also to the relatively high, rapid normal rate of regeneration of the mucosa.

Six graphs; 1 table.

E. S. KEREKES, M.D.
University of Arkansas

Hemoglobin Labeled by Radioactive Lysine. Erythrocyte Life Cycle. W. F. Bale, C. L. Yuile, L. DeLaVergne, L. L. Miller, and G. H. Whipple. J. Exper. Med. **90:** 315–320, Oct. 1, 1949.

A dog, doubly depleted of red cells and plasma proteins, was fed *dl*-lysine labeled with C^{14} in the epsilon carbon position. In the first eight hours 28 per cent of the administered C^{14} was excreted in the urine; in the first seventy-two hours, 35 per cent.

Twenty-four hours after feeding, 4.2 per cent of the fed C^{14} was circulating in the plasma, decreasing to 1 per cent at the end of seventeen days. The C^{14} content of the blood cells increased from 1 per cent at twenty-four hours to 5.5 per cent in five days, and 6. 8 per cent in twenty-two days.

Evidence based on the rate of decrease of the C^{14} content of circulating blood cells is presented, indicating an average life of 115 days for the erythrocyte protein as an entity not interchanging with extracellular constituents. This corresponds closely to the life span of the dog erythrocyte, 112 to 133 days according to the best evidence otherwise available, and indicates that this experiment has actually measured the life span of the dog erythrocyte.

Following break-down of blood erythrocytes, the protein comprising them is not used preferentially for the formation of new erythrocytes.

Two graphs.

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EFFECTS OF IRRADIATION

Radiation Burns, Including Vocational and Atomic Exposures. Treatment and Surgical Prevention of Chronic Lesions. James Barrett Brown, Frank McDowell, and Minot P. Fryer. Ann. Surg. **130:** 593–603, October 1949.

Acute radiation burns result from large single exposures or smaller exposures repeated closely over a short period, as in medical or dental practice, or from atomic radiation. These should be treated conservatively. Rest, sedation, prevention of infection, and alleviation of severe pain are carried out, as well as grafting of open wounds as soon as it is felt that a free graft or flap will survive. If the surface extent of the burn is known, early excision and repair may be done, but even in these instances there may be surrounding involvement by a chronic process that becomes apparent later on. Amputations should not be done as a primary procedure.

The chronic burns, such as those seen on the hands of doctors, result from repeated small exposures over a period of years; however, burns from single exposures may lead to the development of chronic changes. The lesion in the skin is dangerous because it is progressive, with the ultimate development of carcinoma if the patient lives long enough. Effective treatment for the usual chronic burn is excision and repair of the defect with free skin grafts or flaps. Treatment should be done early, or in a quiescent stage, rather than in an ulcerated, infected stage. Removal of the affected area results in the immediate relief of pain. The re-

pair of the excised lesion may be done primarily or secondarily, and there are many points of importance in designing and carrying out treatment of the resultant open areas. The authors believe that once a burn has developed, further irradiation of any type is contraindicated, with the possible exception of cases in which irradiation can be used for treatment of a carcinoma developing in a burned area, in which primary surgical excision cannot be done.

In atomic radiation lesions, symptoms may begin very soon after exposure, and blistering may occur in four to six days. With subsidence of the acute stage, open areas may be grafted to hasten healing. Late development of chronic changes will have to be treated as any other chronic burn. Possibly some late amputations may be indicated.

The authors advocate the prevention of chronic skin lesions in heavily irradiated areas by treatment before chronic changes occur. They cite a case of neoplastic hemangioma involving an extremity which was treated by roentgen rays followed by resection of the irradiated skin and skin grafting with an excellent functional and satisfactory cosmetic result.

Chronic atrophy, whether diagnosed as a burn or not, will probably show up in practically every tumor area treated with radiation. If it were recognized that this might happen and that the atrophic skin should and could be changed, radiation therapy might find wider application and achieve even more brilliant results.

Before-and-after-surgery photographs of eight cases.

WM. H. SMITH, M.D.
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Beta Ray Burns of Human Skin. Norman P. Knowlton, Jr., Edgar Leifer, John R. Hogness, Louis H. Hempelmann, Loren F. Blaney, Dan C. Gill, William R. Oakes, and Charles L. Shafer. J. A. M. A. **141:** 239–246, Sept. 24, 1949.

The clinical course, laboratory observations, and treatment of 4 cases of beta ray burns of the hands are reported. All of the four men were working with radioactive materials which emitted large amounts of beta and gamma radiation. A deviation in the prescribed procedure undertaken to expedite the operation resulted in the handling of these radioactive substances directly with rubber-gloved and sometimes with bare hands rather than with the remote handling devices that had been provided.

Measurement of dosage of beta rays at time of exposure was not obtained, but film badge and pocket ionization chambers worn over the thoracic region indicated gamma ray exposure of 1 to 15 r. The hands probably received ten times this amount of gamma radiation.

The major portion of the radiation consisted of beta rays of average maximum energy of 1 mev. About 90 per cent of such radiation is absorbed in the first 3 mm. of tissue, and 99 per cent is absorbed in 6 mm. The estimated dosage received by the four men was from 3,000 to 16,000 rep. (roentgen equivalent physical). Dosage at 3 mm. depth would be 300 to 1,600 rep. and at 6 mm. depth 30 to 160 rep. Since the whole body exposure did not exceed 15 r of gamma radiation, there appeared to be no danger of a generalized effect, and the patients were therefore treated only for the local injury to the hands. Prior to this exposure all were in good health and had had no over-exposure to radiation.

The clinical course of the skin injuries may be divided into four distinct phases. Phase I consists of initial erythema and edema with blanching in areas receiving the greatest exposure. This begins with the exposure, reaches a peak in about forty-eight hours, and subsides rapidly. Phase II comprises a period of relative absence of signs and symptoms for three to five days. Six to eight days after exposure Phase III begins with development of secondary erythema, complicated in some cases by extravasation of blood into the erythematous areas. Vesicles appear in the reddened areas, and for about two weeks the erythema spreads and vesicles increase in number, finally coalescing to form extensive bullae. About twenty-four to thirty-two days after exposure the active process becomes arrested. Bullae dry and desquamate, and epithelialization follows in areas where the vascular supply has not been seriously damaged. Phase IV is the chronic stage, in which some areas with serious vascular damage remain unhealed. In the less severely damaged areas the epidermis is atrophic, with absence of hair and sebaceous glands. Secondary ulcerations occur and hyperkeratoses, telangiectasis, and malignant degeneration may be late results.

At the end of observation, seven to twelve months, the three most heavily exposed patients had considerable atrophy of soft tissue and impaired motion or ankylosis of several phalangeal joints. Nail growth was retarded in all cases. In one case epilation of the dorsum of the fingers occurred. In all patients palmar sweating temporarily ceased. At the end of four months capillary loops in nail beds were decreased in number and had formed collaterals.

The observed elevation of the total white blood count, the neutrophil count, and the sedimentation rate appeared to run parallel to the development of vesicles and bullae on the hands and the febrile response. The absolute lymphocyte count did not change, but an increased number of refractive granules in these cells was noted in supravital preparations. An unexplained increase in reticulocytes of 1 to 2 per cent was observed.

Treatment consisted of immobilization, elevation, and cooling. Rutin was administered, and penicillin was used prophylactically at time of drainage of bullae or débridement. No secondary infection occurred. Débridement followed by pressure dressings under general anesthesia was used in Phase III in 3 cases. In 3 patients skin grafting in unhealed areas gave satisfactory "takes." The stiffening of the fingers was treated with active and passive manipulation. These patients must now be followed in the years to come for the development of other changes subsequent to this irradiation.

Ten photographs; 2 graphs.

M. M. FIGLEY, M.D.
University of Michigan

Severe Tracheobronchial Lesions in Cases of Bronchial Carcinoma Treated by X Rays. R. C. Nairn. J. Faculty of Radiologists **1:** 131–135, October 1949.

The author recently observed 3 cases of severe tracheobronchitis at autopsy in patients who died during a course of deep roentgen therapy for bronchial carcinoma. These lesions might have been ascribed solely to the effect of radiation but for the unusual severity and the fact that the irradiation received had been well within the accepted tolerance dose, since the series was incomplete in all 3 cases.

Three factors are considered in the etiology. The x-ray therapy probably played some part, since the

severity of the lesion in each case was definitely related to the dosage given, though the proposed course was not completed. Continued contact of the respiratory mucosa with grossly infected secretions is also a possible etiological factor. A third factor, and one which seems to have played some part in the cases reported, is the mechanical trauma of bronchoscopy and biopsy.

Three photographs; 1 diagram.

D. R. BRYANT, M.D.
The Henry Ford Hospital

Can the Defence Mechanism of the Body Be Influenced by Roentgen Irradiation? Report on a Preliminary Clinical Investigation of the Plasma or Serum Protein Pattern in Rheumatoid Arthritis. H. Ney. Ann. Rheumat. Dis. **8:** 191–204, September 1949.

To investigate the biologic properties of x-rays, it was decided to study the possible effects of small doses of radiation on the resistance of the body, and for this purpose it was considered that patients with rheumatoid disease were suitable. The plan decided upon was made up of four parts: (1) soft radiation (50 kv.) to the trunk (this is mostly absorbed in the skin); (2) penetrating radiation (200 kv.) to the trunk in the same "volume dose" as given by the soft radiation; (3) penetrating radiation (200 kv.) to the trunk in the same "surface dose" as the soft radiation; (4) penetrating radiation locally in the same volume dose as in (1) and (2).

It was intended to proceed in the same patient from one scheme to the others in the order given and to note the effect both clinically and through laboratory investigations which might provide indications of favorable or unfavorable effects of treatment. The present paper is an account of the first stage of the scheme.

Nine cases of advanced rheumatoid arthritis which had failed to respond to standard therapeutic measures were treated by the wide-field technic, using soft x-rays (50 kv.), h.v.l. 0.33 mm. Al, and doses of 5 to 50 r weekly for four to eight weeks. The cases were all apparently similar clinically (except for degree of severity), but low serum albumins and high globulins were found in 6, and nearly normal values in the other 3.

Following treatment, the 6 patients responded favorably, with clinical improvement and a return of the albumin-globulin pattern to normal. Of the remaining 3 patients, 2 showed no clinical improvement and unfavorable movements in the albumin-globulin pattern; the third (borderline case) improved belatedly (so far for a short period) both clinically and in the protein pattern.

Functional liver tests in the 6 responding patients revealed no abnormality, but definite abnormality was found in the 2 non-responding cases and slight abnormality in the remaining case.

It is suggested that: (1) The serum albumin-globulin pattern is an unspecific but reliable indicator of the body's reactive state; (2) soft wide-field x-ray irradiation can influence a pathological albumin-globulin pattern, at least in cases of rheumatoid arthritis; (3) a return to more normal albumin-globulin levels is followed by clinical improvement in rheumatoid arthritis; (4) a shift in the protein pattern in the right or wrong direction foreshadows clinical improvement or deterioration; (5) an adverse shift of the albumin-globulin pattern does not necessarily signal an imminent flare-up of the rheumatoid arthritis, since such a shift may be caused by intercurrent disease, without manifestation of a relapse in the arthritic process.

Nine charts; 2 tables.

Androgenesis, a Differentiator of Cytoplasmic Injury Induced by X-Rays in Habrobracon Eggs. Anna R. Whiting. Biol. Bull. **97:** 210–220, October 1949.

Any technic which differentiates cytoplasmic from chromosomal injury induced in the living cell by x-rays is of interest to investigators of biological effects of ionizing radiations. Injury to chromosomes is measured by their breakage and rearrangement and by visible and lethal mutations. Injury induced in the cytoplasm must, ordinarily, be studied by means of tests for physical and chemical changes in treated cells or by changes in behavior of the cell as a whole, inhibition of division, etc. In a study of this subject, wild type *Habrobracon* females were irradiated and mated to untreated recessive males. Two kinds of haploid males were produced, gynogenetic (irradiated chromosomes in irradiated cytoplasm) and androgenetic (untreated chromosomes in irradiated cytoplasm). Gynogenetic males develop from the unfertilized eggs, androgenetic males from fertilized. Death of the former and origin of the latter are caused by different degrees of the same type of x-ray-induced chromosomal injury.

Some androgenetic males survive after doses over twenty times greater than that which is lethal for chromosomes of eggs in which they develop. At all doses they resemble the controls and differ significantly from gynogenetic males in visible mutation rate, viability, and fertility. The changes peculiar to gynogynetic males must be chromosomal in origin, since both types of males develop in irradiated cytoplasm. Evidence suggests that these changes are directly induced and supports the target theory of chromosomal injury.

Since there is no evidence for chromosomal injury in surviving androgenetic males, the reduction of their number at doses above 15,000 r, through embryonic death, must be directly cytoplasmic.

The increase in survival of both gynogenetic and androgenetic males in response to fractionation of dose must be due to reduction of cytoplasmic injury, since they have only irradiated cytoplasm in common.

Two charts; 1 table.

An Experimental Study of Back-Scatter with X-ray Beams of Small Area. D. V. Mabbs. Brit. J. Radiol. **22:** 600–604, October 1949.

Measurements of back-scatter values for x-ray beams of 10 cm. diameter were made with a micro-ionization chamber in both water and wax phantoms. The results are presented in graphs. The findings in the wax phantom agree well with the measurements previously made by Quimby, Marinelli, and Farrow (Am. J. Roentgenol. **39:** 799, 1938. Abst. in Radiology **32:** 371, 1939), and those in water with measurements made previously by Mayneord and Lamerton (Brit. J. Radiol. **14:** 255, 1941. Abst. in Radiology **38:** 641, 1942). The causes of this variation is discussed.

In the range of radiation of half-value layer 1.4 mm. Cu to 0.3 mm. Cu there is little change in back-scatter with quality. However, with a half-value layer of 0.06 mm. Cu there is a very rapid decrease in back-scatter.

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